MAY 17 1926

Electrical World

The careful investor judges a security by the history of its performance.

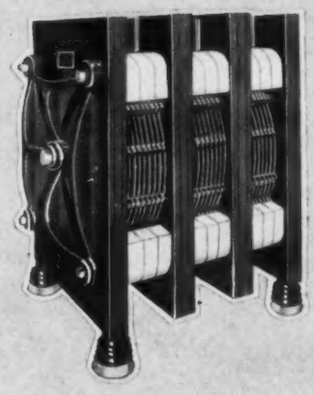
KERITE

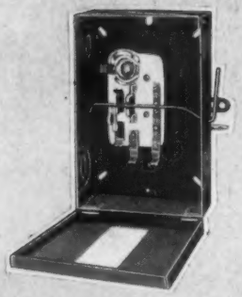
in a half-century of continuous production, has spun out a record of performance that is unequalled in the history of insulated wires and cables.

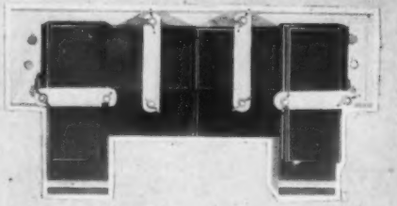
Kerite is a seasoned security.

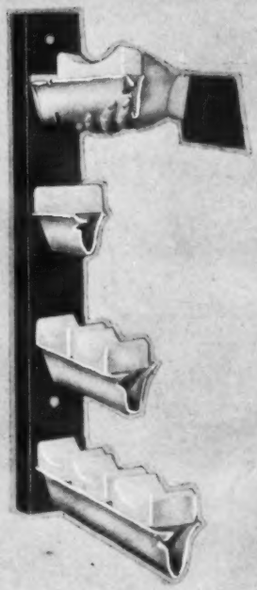
THE KERITE INSULATED WIRE & CABLE CO. INC.

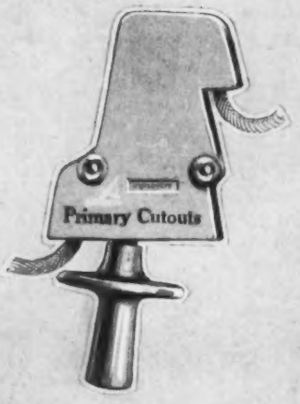
MURRAY
ELECTRICAL PROTECTIVE DEVICES











In Booth 389 at

ATLANTIC CITY

These devices will be shown and demonstrated

CURRENT LIMITING REACTORS used in largest generating and distribution systems to protect the equipment during short circuit stresses.

METER SERVICE SWITCHES accessible or sealed main fuses, with or without accessible branch fuses.

SUBWAY SECTIONALIZING UNITS for connecting sub-feeders, tie-lines and service taps to underground distribution systems.

OIL FILLED HIGH TENSION CABLE JOINTS offering safe and reliable splicing between underground cables.

CONDUIT SYSTEMS providing the ideal conduit for subway distribution,—monolithic concrete duct.

Also PADLOCK METER SEALS, DUMMY PLUGS, CABLE RACKS both overhead and underground, FAIRLEADERS, PRIMARY SWITCH TYPE CUTOUTS, METER CONNECTION TEST BLOCKS.

New Literature will be sent to those not in attendance upon request.

METROPOLITAN DEVICE CORPORATION

1250 Atlantic Avenue

Brooklyn, New York

Electrical World

Published by McGraw-Hill Publishing Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 87 — *New York, Saturday, May 15, 1926* — NUMBER 20

Lightning Protection Needed to Prevent Oil Fires

RECENT fires in California started by lightning in which more than fifteen million barrels of crude oil, valued at more than $10,000,000, were destroyed show the necessity for some means of protecting oil tanks against this danger. Here is an opportunity for the electrical engineer to apply his knowledge of lightning phenomena to the protection of oil-tank properties and prevent this great loss.

By exercising the greatest care the oil companies have been able to keep fires started from causes other than lightning to a minimum, and by earth dikes and other means they have been able more or less to prevent fires that do start from spreading from one tank to another. Surely there must be some way of protecting oil tanks against lightning, too. Several of the California oil companies are already experimenting with steel towers which presumably will act as lightning rods to protect a certain area. This is one possible solution. Perhaps a network of overhead ground wires supported by steel poles and thoroughly bonded to the tanks, forming an overhead ground grid completely covering the area occupied by the tanks, would prevent a direct lightning stroke getting to the tanks. An air-tight all-metal thoroughly grounded metal tank system is very difficult to obtain under the working conditions encountered in tank "farms."

Recent lightning research work may suggest other protective measures. At any rate, here is a problem that is receiving the close attention of electrical and mechanical engineers in the endeavor to prevent this great pecuniary loss, to say nothing of the waste of an important natural resource and the possibility of loss of life.

Value of Co-operation in Rural Electrification Work

THE Southern rural electrification conference that was held in Montgomery, Ala., recently was a meeting of a comparatively small group of men of the Southeastern States who are vitally interested in rural progress and who are trying to put before the farmers and others interested the benefits to be derived from this work along with the problem of how it shall be carried out. It was evident that every one went away from the conference with the impression that rural electrification was not a simple thing and that a great deal of research and application work has still to be done, even if some of the fundamentals are now understood.

The power company representatives felt upon the conclusion of the meetings that agricultural schools, farm bureaus and the farmers themselves had received information that will enable them to tell the story of rural electrification to the public. The excellent paper by E. C. Easter of the Alabama Polytechnic Institute on the work that has been accomplished in Alabama went a long way in showing that there really is something in rural work and that the farmer is anxious for service.

The discussion of rural costs brought out the fact that no return can be realized on the money invested for the first few years, but that after the farmer is on the line he gradually builds up his load until it is profitable. As an example of this, there is one line in Alabama that has been in service since 1920. At the beginning this line served one cotton gin and ten farmers. At the end of 1925 there were still only ten farmers connected, all of whom with one exception were the original customers. The only additional customer since the first year is a 7½-hp. gristmill. At the end of the first year 18,000 kw.-hr. had been used, while for the year 1925 a little more than 60,000 kw.-hr. was used, an increase of over 325 per cent.

One very important thing that was brought out is that the farmer during the last few years has been learning the value of co-operation, first with his own group, second with his banker, third with the manufacturers, and fourth with the power company. The power companies are going to gain very much in knowing at first hand what the farmer is thinking about and in working out with the farmer the various problems confronting them both.

Depreciation Reserves Belong to the Utility Company

A VERY important decision affecting the relations between a utility and its customers has been rendered by the Supreme Court of the United States in the case of the Board of Public Utility Commissioners of New Jersey versus the New York Telephone Company. An appeal was made from a temporary injunction of a district court restraining the enforcement of certain telephone rates. Since the case hinged very largely on the question of depreciation reserves, it is of interest to other utility companies as well. In its decision the Supreme Court held that "customers pay for service, not for the property used to render it. Their payments are not contributions to depreciation or other operating expenses or to capital of the company. By paying bills for service they do not acquire any interest, legal or equitable, in the property used for their convenience or in the funds of the company. Property paid for out of moneys received for service belongs to the company just as does that purchased out of proceeds of its bonds and stock. It is conceded that the exchange rates complained of are not sufficient to yield a just return after paying taxes and operating expenses, including a proper allowance for current depreciation. The property or money of the company represented by the credit balance

in the reserve for depreciation cannot be used to make up the deficiency."

While it is perhaps not for us to judge or construe the entire logic of the opinion, the court does say that what is earned under lawful rates belongs to the company, and that it is not a trust fund. In this the highest court sustains the circuit courts of appeal, which have held that depreciation reserves do not determine value of property used and cannot be deducted in arriving at value. The decision also appears to be in harmony with the retirement reserve provision of the uniform classification of accounts now adopted by the electric light and power companies of the country with the exception of those operating in California. Naturally the telephone companies are pleased with the decision; any companies with the huge depreciation reserves of the telephone companies would be. It may be, however, that because of the decision the telephone companies of the country will modify their classification of accounts and bring it into closer harmony with that promulgated by the state commissions. Some state commissions and a few public utility companies will also hereafter have to modify their notions on depreciation.

Further Data on Impregnated Paper

IN CONNECTION with no problem in electrical engineering is there at present greater activity in experimentation and research than that of the properties, performance and life of impregnated paper insulation. Owing to the large number of variables which enter into the structure and into the conditions of service of this type of insulation, it may be safely said that such degree of excellence of performance and length of life as has been obtained is more largely due to empirical tests and development than to rational application of underlying principles. The attempt to follow the bearing of one or more underlying principles through a process of experimentation is obscured almost from the start by the difficulty of controlling the operation of other principles and by the unavoidable presence of extraneous properties whose values cannot be controlled. It is, indeed, one of the most baffling problems ever encountered by the research engineer. Nevertheless, the work goes on, and there are at present under vigorous prosecution, both in this country and abroad, a considerable number of special investigations. The results of one of these, made in England by P. Dunsheath, was recently reported in the *Journal of the Institution of Electrical Engineers*, and it presents new and interesting data.

The principal object of all investigations of this character is to trace the connection between the direct-current and the alternating-current characteristics of the insulation. The direct-current characteristics are the dielectric absorption, the final resistance and the variation of each with temperature. Moisture is a disturbing factor which may obscure completely the other fundamental characteristics unless it is carefully removed as a disturbing cause. Mr. Dunsheath concludes that the change of the direct-current absorption current of a dielectric is best represented by a negative exponential of the time. He shows for a number of different dielectrics, however, that the value of this exponent may change in the curve of any one substance, that it may be obscured by a change with time of the conductivity of the material, and he traces the character of the change with a change in the ingredients of both paper and compound. It has been realized for a long time that such results were probable, and it is remarkable that there are so few data such as those now presented. A study of the characteristics of composite insulation as based on the characteristics of the different constituents is of fundamental importance in the problem of controlling the properties and performance of the final product.

Data are also presented of tests looking to a relation between the alternating losses and the direct-current characteristics. An important conclusion is that if the negative exponent of the time in the absorption current curve is equal to "one," then the power factor of the dielectric due to the absorption alone should be equal to zero. This is an important conclusion which before being accepted must be examined carefully in the light of existing theory. If found to be true, it will have an important bearing on the problem of the control of composite insulation, for it should not be a difficult matter to find methods for controlling the value of the negative exponent of the time.

Another series of data pertains to the well-known V-curves between power factor or dielectric loss and temperature. These curves are found to have the same form and properties at low voltage as at high voltage. This permits comparison between alternating-current and direct-current losses. It is found that the shape of the curve pertains to the property of absorption alone. Contrary to the assumption that has often been made, it is shown that even at the highest temperatures losses due to absorption are many times as large as those which can be accounted for by resistance alone.

Slow Motion Pictures Aid in Studying Circuit-Breaker Action

EXPERIMENTS made in Los Angeles recently with slow motion pictures for timing circuit breakers suggest further application of the slow-motion-picture camera in the electrical industry. While the experiment referred to was intended to aid in the timing of the breaker, it was found, much to the surprise of the engineers, that there was a pause and an actual reversal of the moving contacts during the opening cycle. To the eye this was not apparent, but the great speed of the slow-motion-picture camera, making 160 exposures a second as against sixteen per second in the ordinary motion-picture camera, so slowed down the motion of the moving parts of the breaker as to make it possible to see clearly just what happened. Investigation showed that the reversal of the blades was due to the particular design of the operating mechanism. Thus it was possible to correct a fault in the breaker that materially reduced its interrupting capacity. It is, of course, possible to make an oscillograph set-up which would show practically the same thing, but the slow-motion-picture camera has the advantage of being easily and quickly set up and of giving a photographic record readily interpreted by the average engineer.

This experience suggests the use of the slow motion picture for studying the action of moving parts of other electrical apparatus and certain kinds of electrical phenomena—for instance, the timing of relays, sequence of operation of contacts in various types of apparatus, study of arcs, especially in connection with air-break

switches and fuses, etc. It seems, therefore, that the slow motion picture has a wide field of application in conjunction with the oscillograph and between the oscillograph and the ultra-high-speed photographic equipment used by the large manufacturers in their research laboratories.

Needed—a Sense of Proportion in Selling

VOLUME of sales in any business is almost directly proportional to the sales and advertising effort expended. But, in spite of the magnitude of undeveloped markets for additional loads, the idea of an electric utility appropriating between 5 and 10 per cent of its gross annual income to promote the sales of its service has in the past been too radical to receive serious consideration. Under existing conditions it would not be in line with the time-honored, conservative policy of the industry—it might bring the accusation that the management is too greedy for additional revenues. Still, in other classes of business, such as the department, furniture, jewelry and specialty stores, selling expenses of 10 to 12 per cent are considered to be good practice. In addition, these merchants spend from 3.5 to 5.5 per cent of their gross sales for advertising. In contrast with this, many central-station companies consider that they are doing a "bang-up" selling job when their sales promotion expense amounts to 1 per cent or at most 2 per cent of gross income and between one-quarter and one-half of 1 per cent is appropriated for all kinds of advertising and publicity.

Many reasons could be assigned for this comparatively low percentage of central-station selling expense, but the ultimate result has been finally to help fix the industry's attention on the need for more effective selling. If anything of consequence is to be accomplished in this direction, an entirely new conception of the size and policy of new-business departments will have to be forthcoming. Most companies are conducting their commercial operations along two lines—industrial sales engineering and appliance merchandising. The cost of conducting the first is distinctly a promotion expense and is chargeable directly against the sale of energy. Appliance selling, however, is undertaken with the idea of making this department self-supporting, some companies even hoping for profit with which to pay the cost of industrial and lighting sales. In a measure this policy has been successful as it has kept the total promotion expense low. So greatly, however, have some companies become obsessed with the fetish of a self-supporting sales department that they have almost lost sight of the fact that what they are really trying to sell is more kilowatt-hours.

Now, it looks fine on a financial statement to see that the sales promotion expense was only 1 per cent of the total gross revenue, but when it is considered that the increased annual income of 10 or 12 per cent per year is not much more than normal growth, the wisdom of holding down the sales expense can be seriously questioned. What would the increased revenue have been if 5 or 10 per cent of gross income had been expended in sales development?

It is true that the utilities are not losing customers. On the contrary, the degree of permanency of customers is probably greater with power companies than in any other business. In many places customers show an average length of service at one address of ten years—many for a much longer period. As a matter of fact, when a new load is added to the lines the utility company may reasonably expect not one year's but ten years' revenue. It is on this basis that appropriations for sales expenditures should be made. Suppose that a company spent this year 10 per cent of its gross revenue for sales promotion. It would in reality be spending only 1 per cent of the revenue it will receive from its present business during the next ten years. Such a basis for new-business expenditures is cited merely to illustrate what might be expected if it were necessary for the utility to enter into sales negotiations with all of its customers every month or every year, as do other merchants.

A more reasonable and perfectly logical method of budgeting sales expense would be on the basis of the revenue to be derived from new business taken on. If a company allowed its sales department to expend an amount equal to one year's gross revenue from the new load added, it would be equivalent to a selling expense of 10 per cent of the income over a ten-year period and in line with the selling costs in other kinds of business.

At the present time no company is manned or organized to operate its commercial department so that it could efficiently spend 10 or even 5 per cent of the present gross annual revenue for sales development. But if system load factors are to be improved, if a better ratio of investment turnover is to be effected, if the kind and quantity of new loads are to be added that will bring this about, the central-station industry will have to get an entirely different perspective on selling and the amount of money that it can legitimately spend for building additional load and revenue. Ten per cent for selling may seem a lot to this industry now, but it is accepted practice with other merchants in carrying out their regular sales programs.

Financial Economy of New Applications

VARIOUS methods of increasing the net head on hydraulic plants through the utilization of excess flow have been applied recently. They include the Herschel "fall increaser," Replogle "discharge accelerator," Tefft "conduit spillway," Thurlow "backwater suppressor" and Moody "ejector turbine." Actual operating experiences with several of these schemes are being collected by the hydraulic power committee of the N.E.L.A. and when compiled will be presented in serial report form.

The operating data on these methods will be valuable and should be added to from time to time. Equally important, however, is their financial economy. In other words, how much are the fixed and operating charges on them compared with the advantages derived? All of the items of interest, depreciation, taxes, etc., on the investment represented must be added to the operating and maintenance expense.

This question is not raised because their value is doubted, but because the cost of all equipment used to increase efficiency, reliability, etc., should be balanced against its value if the maximum return on the dollar invested is expected. And that is what executives, security holders and the people who buy electricity are interested in.

Maurice L. Sindeband

who, as engineer, inventor and executive, has contributed brilliantly to the successful development of the electrical power industry and of the electrical utility holding company.

AMONG the engineers who became affiliated with some of the early electrical utility holding companies none probably contributed more effectively toward their proper development and prosperity than Maurice L. Sindeband, who has recently been elected a vice-president of the American Gas & Electric Company.

Born in 1885, he received his education at Columbia University and started his engineering career in 1907 with the New York Central Railroad. His next occupation was station-design work with the Brooklyn Edison Company, which he left in 1915 to enter the engineering department of the American Gas & Electric Company. His rise here was rapid, and he was advanced to the post of electrical engineer in 1918. In this position he carried on an extensive development work in high-tension transmission, in carrier-current communication and in outdoor substation operation. His work in behalf of distribution and substation standardization, especially the former, is well known. He was one of the first to work out every engineering phase of a large-scale interconnection between two foreign companies and the corresponding problems in connection with tying in large and separated properties of a holding company and the shutting down of inefficient generating machinery.

Besides carrying on his development work, Mr. Sindeband has been a fertile and resourceful inventor, having to his credit patents covering automatic train control, saturated core reactors and regulators, carrier-current communication and short-circuit current-control systems. He has also written for the technical press and has read several papers before the A. I. E. E. when his duties have permitted. He is a member of the New York Electrical Society, the N. E. L. A. and the A. I. E. E. and has served on numerous committees of the latter two.

In spite of carrying on every engineering phase—including planning, designing, constructing and operating—of the work, large and ever-growing, of the electrical department of the American Gas & Electric Company, Mr. Sindeband has devoted a large part of his time in the past five years to executive work, and of this his promotion is a fitting recognition. He is the type of engineer who develops the broad-gage viewpoint and perspective necessary in executive positions in the ramified utility organizations of today.

Motor Driving Problems in Box Factory

Power Requirements Are Outlined—Basic Reasons for Determining the Selection of Motors for Individual or Group Applications—Trend Toward Individual Driving

ON ACCOUNT of the variety of processes required in the manufacture of paper boxes, and, in addition, the wide difference in the operation of these processes, the use of motor-driven machines in this industry is of striking interest to those concerned with motorization problems.

The C. F. Hatch Company, Lowell, Mass., manufacturer since 1875 of high-grade paper boxes and special wrappings, offers an unusually interesting study of how far individual drive has advanced in certain box-making operations and to what extent group drive has worked out in connection with these operations.

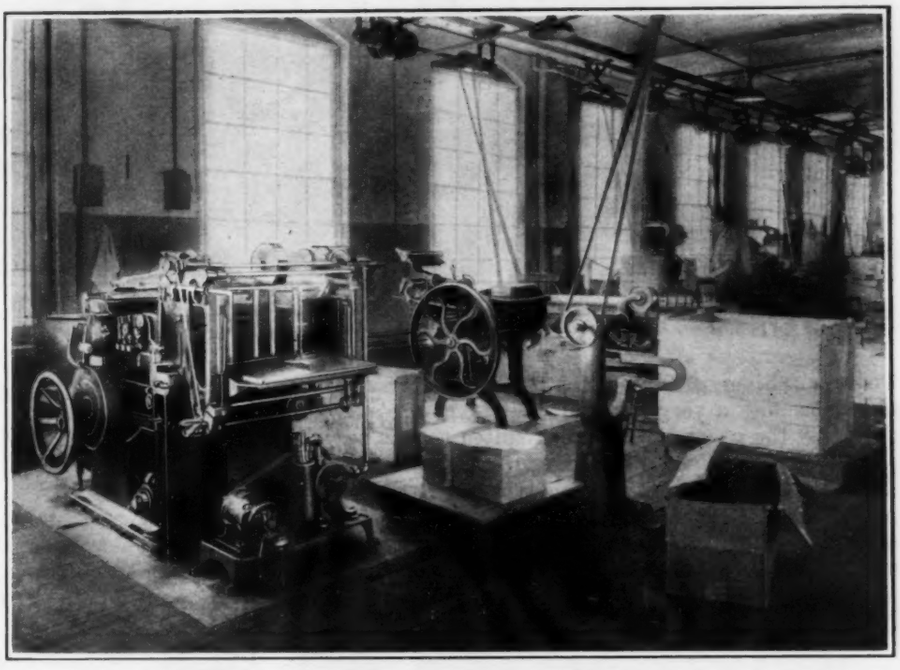


FIG. 1—PRESSES WITH BOTH INDIVIDUAL AND GROUP DRIVES

In 1924 this company, on account of a considerable expansion in business, acquired a new location and arranged for complete motorization of its equipment. This development, worked out by French & Hubbard, consulting engineers, Boston, although as yet not complete in many details, nevertheless presents a solution of certain phases of the problem of motorization.

Electric service for this plant is furnished by the Lowell Electric Light Corporation at 2,300 volts. Energy is stepped down to 550 and 220 volts for general power purposes, and, in addition, to 110 volts for other requirements. In the following list, which includes the principal machines that are individually driven, the motors are three-phase induction type, running at 1,200 r.p.m.

There are several Miehle rotary presses, one of which is driven by a 10-hp. motor and the others by 5-hp. motors; Kelley presses driven by 1-hp. and 1½-hp. motors; staying machines driven by 5-hp. and 1-hp. motors, a group of connected wrapping and gumming machines taking about 0.1 hp. each, and staying machines with ½-hp. motors each. The transmission equipment on these machines is quite uniform throughout and consists of 3-in. motor pulleys with 4-in. faces carrying 3-in. belts to a 16-in. driving pulley on each machine.

The group drive consists of the following: A group of cutting and creasing machines operated by one 15-hp. motor; job platen presses, 7½ hp.; staying machines, one 5-hp.; miscellaneous box machines operated in a group by one 15-hp. motor; special box machines, one 7½-hp. motor, and cutters and stitchers, 7½-hp. motor.

The selection of the type of drive best suited for the making of boxes is based on load and speed requirements, and, in addition, on the relation among various mechanical steps in the process of box manufacture.

Large rotary printing presses are operated as separate units and are individually driven, a feature that economizes in power and insures close control of speed. This type of drive is especially suitable for these machines, because of intermittent shutdowns necessitated by type set-ups, color regulation and pressure adjustments. Cutters and creasers on the other hand, when arranged in a group, as in this plant, appear to give best results with the group drive. When formerly individual drives were tried on this type of press, a 6-hp. motor was required for each machine. This proved unsatisfactory because of frequent blow-outs of fuses and motor burnouts, which were traced to an overload developed in overcoming the inertia of the press plates when in contact. In using the group drive, not only was the power consumption reduced, during service with one 7½-hp. motor as shown in Fig. 1, but the added momentum gained through shaft drive counterbalanced the factor of inertia and thus solved an interesting problem in operation.

Cutting and creasing machines operate at a constant speed and nine of them require one 15-hp. motor, these processes being continuous and thus favorable to the group drive from the standpoint of power economy. In this category is also included a group of fourteen machines, as shown in Fig. 2, driven by a 15-hp. motor.

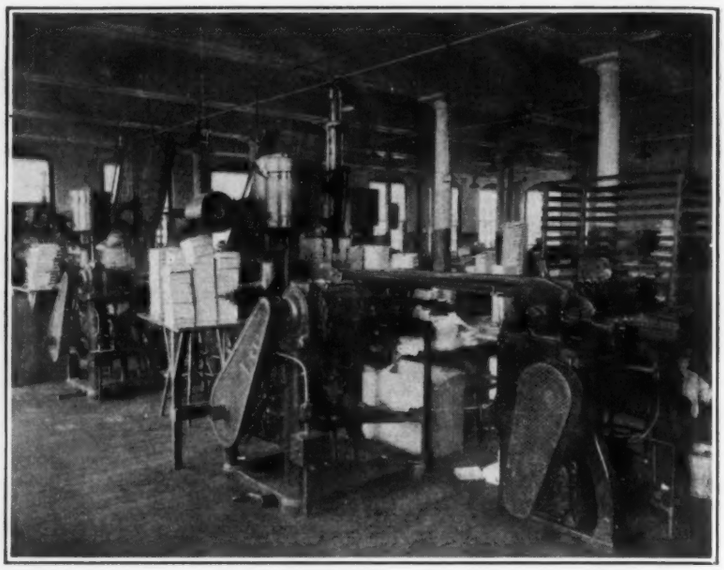


FIG. 2 (AT LEFT)—BANDING MACHINES DRIVEN BY OVERHEAD MOTOR. FIG. 3 (AT RIGHT)—INTERCONNECTED STAYING AND GUMMING MACHINES WITH SEPARATE DRIVES

These machines are used for various processes, but each consumes a very small amount of power and consequently the group drive is well suited to this service.

Individually driven units, shown in Figs. 3, 4 and 5, illustrate the adaptability of this type of drive to special process machines. An unusually interesting application shown in Fig. 3 is the separate motorizing of two machines functioning together mechanically. One is a gumming machine running at constant speed with a trip control connected with a box machine, the latter being operated at variable speed from a motor selected after considerable investigation on the part of the Hatch company, and which now has been adopted as a standard in operations of this nature. In this combination of machines, the gumming machine must operate continuously or the product will be injured, but the boxing machine may be stopped or its speed regulated according to the conditions. Separate driving is

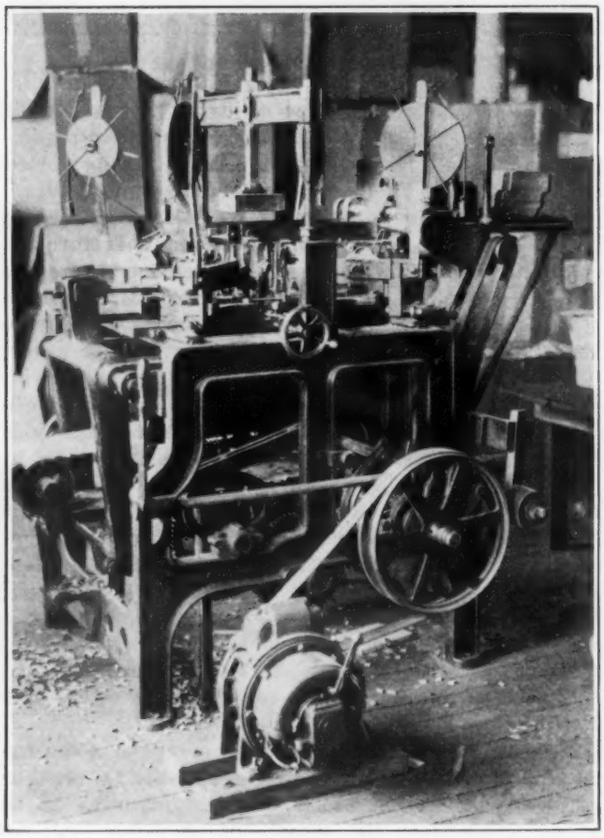


FIG. 4—INDIVIDUALLY DRIVEN BOX-STAYING MACHINE IN OPERATION

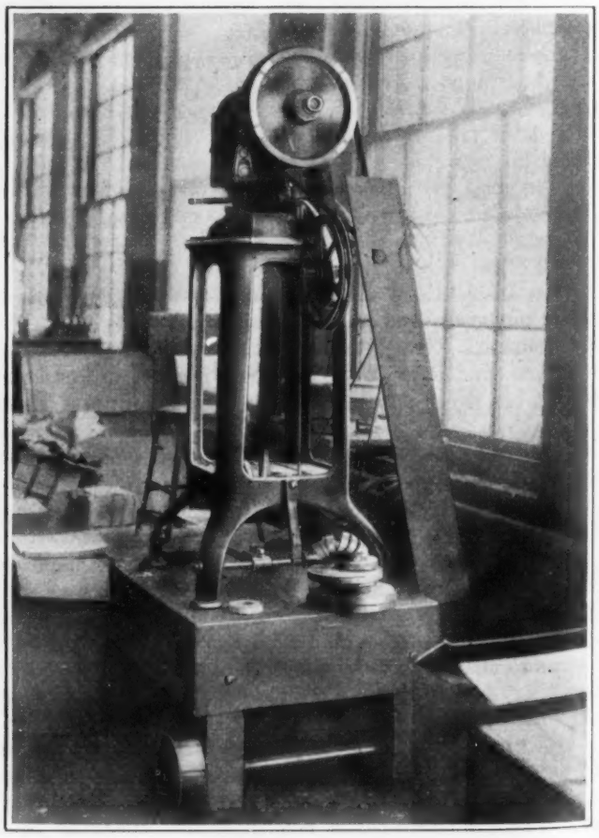


FIG. 5—PORTABLE BANDING MACHINE WITH INDIVIDUAL MOTOR MOUNTED ON A SIDE BRACKET

vitally necessary to the successful operation of the unit.

In Fig. 4 is shown a quadruple box-staying machine driven by a 1-hp. motor. This type of machine, which produces from 55 to 65 folds per minute, is a complete unit. Equipped with this type of drive, the process can be conducted without danger from dust, oil or grease, and, in addition, it minimizes power consumption in overtime work and special job lot orders, during which one or more machines of this type are run alone.

Portable machines are valuable in saving time and labor in many manufacturing processes, and in box making this type of equipment is much in favor. As a complete unit with its individual drive, shown in Fig. 5, a banding machine can be used as a separate unit or be aligned with a group of other type units, thereby eliminating trucking and handling of materials during production.

The trend toward individual drives in box factories is indicated by the following considerations: (1) An important point in favor of this type of drive for box making is its flexibility in the control of operating speed, a factor of no small consequence in training employees. It is also vital in maintaining a maximum quantity production commensurate with individual ability. (2) Dust, dirt and soot, very adverse factors in paper processes, are eliminated, and danger from oil drip, dust webs and grime deposits on shafts and around bearing boxes is overcome. (3) Finally, there is the reduction in power consumption closely associated with the individual drive except under unusual conditions of light load operation for groups of machines. There should be added the item of power saving in intermittent operation as well as in overtime production, when special "catch-up" operations are required.

Plans for further extensions of the individual drive are being considered by the Hatch company in view of the striking advantages already obtained through its use in this establishment.

Reports of Ether-Drift Measurements

Recent Data of Dr. Miller Deny Fundamental Postulate of Einstein Theory—Observed Drifts Attain 10 Km. per Second—Some Speculations Advanced

By A. E. KENNELLY
Professor of Electrical Engineering Harvard University

A VERY interesting address was given on March 10 by Prof. D. C. Miller of the American Academy of Arts and Sciences in Boston on the subject of his latest observations of apparent ether drift at Mount Wilson, California. This subject is of world-wide interest. Not perhaps since the great dissension over the question of spontaneous generation has the scientific world been so divided over a question of the interpretation to be placed upon an experimental phenomenon.

In 1887 Michelson and Morley published the result of their famous experimental interferometer inquiry, as to whether a beam of light could be found to move in their laboratory any faster in the direction of the earth's orbital motion than across that direction. The earth's orbit around the sun is about 940,000,000 km. long, and there are about 31,500,000 seconds in a year; so that the mean orbital speed is nearly 30 km. per second. If a beam of light is set in the laboratory, so as to advance parallel to this motion, will it be hastened by this amount? The speed of light being 300,000 km. per second, it might be 300,030 when going with the earth's motion, and 299,970 when going the opposite way. They made the trial, and could not detect any effect on the apparent speed of the light beam, so far as the earth's orbital motion was concerned. It seems that there were certain small observed differences between the speed of the light beam in different directions; but none that could be correlated with the earth's orbital movement. These differences were regarded as observation errors.

Starting with the result attained in this classical experiment, Einstein undertook to ascertain what would happen in the mathematical relations between space and time, on the postulated assumption that, in the nature of things, it would be impossible for any observer to affect the apparent speed of light passing him by imparting any speed to himself. Proceeding in this way, he built up his famous theory of relativity, which has so profoundly stirred and interested scientific thought during the last fifteen years. Einstein was able to make three new deductions from this theory, two of which have been experimentally confirmed, according to the general opinion of physicists, and the third is believed by some of them to have been confirmed. Moreover, the Einstein theory fits in well with electromagnetic theories of light and of dynamics.

Experiments with the interferometer repeated in 1904 at Cleveland, Ohio, again failed to show changes of apparent light speed that correlated with the earth's orbital motion; but they revealed, nevertheless, changes, amounting to a few kilometers per second, of a complex and wandering nature.

Electrons Become Currents When Matter Moves

Meanwhile it had been pointed out by Fitzgerald and by Lorentz that if matter is built up of electrons, these would virtually become electric currents, when the matter they form is moving. According to the recognized principles of electric currents, they would attract and repel one another as long as the motion persisted. The net result of these internal reactions among the moving electrons would be to shrink the mass to which they belonged in the direction of the motion. A solid body set in motion, such as a bullet fired from a gun, would shorten its length, by reason of the electrodynamic effects of all the electrons within the molecules, during the bullet's flight. The shrinkage would be infinitesi-

mal, however, and far below the possibility of being measured at any speeds that can be imparted to bullets. At speeds which approach the velocity of light, the shrinkage in length along the direction of motion should attain appreciable proportions. At a speed equal to that of light, the shrinkage should be complete, or the bullet should flatten down to a mere disk in thickness, while its inertia should become indefinitely great. Even at the earth's orbital velocity of 30 km. per second, the shrinkage of the whole earth along the diameter of its motion would amount to only one two-hundred millionth, or to 6.5 cm. Nevertheless this minute shrinkage of the interferometer base in the laboratory would be just enough to compensate for and suppress the apparent effects of the earth's orbital speed and account for the null effect observed.

Morley and Miller in 1905 repeated the interferometer test on a hill near Cleveland and were impressed by the wandering changes of apparent light speed observed when the interferometer table was turned from one azimuth to another at different hours of the day. Morley having retired from active laboratory work, Miller had an opportunity afforded him, in 1921, to resume the inquiry, through the generosity of a Cleveland resident, who assumed the expenses of the research. Miller set up a new and improved interferometer on Mount Wilson, California, close to the famous astronomical observatory which there overlooks the Pasadena plain.

On the basis of an assumed stationary ether, through which the whole earth sailed freely, the original theory of ordinary dynamics should show, as above mentioned, a drift of 30 km. per second under the most favorable conditions as to lay of the base or table, and any drift from this down to zero, depending on the hour of the day and the season of the year. Miller made many thousands of individual observations, using sixteen directions or azimuths of the table in each single series, and numerous series at different times of the day and different months of the year. Ether drifts of as much as 10 km. per second were commonly recorded, in a more or less regular manner, or about one-third of the earth's orbital speed. At first it was surmised that these larger drifts were associated with the greater height of the observing station above sea level, the original Michelson-Morley measures having been made in the basement of the Case Scientific School in the city of Cleveland.

More recently analyses of the entire series of the experimental results have, however, failed, as it seems, to establish a correlation between the amount of the drift and the height of the observing station. But although the observed drifts on Mount Wilson usually attained 10 km. per second and fluctuated, the component that could be attributed to the orbital speed of the earth has always been much less than this. Various explanations have been suggested for the observed drifts, such as temperature effects, magnetic effects, gravitational effects, etc., without success. In order to reduce the temperature changes caused by breezes up and down the mountainside, the site of the interferometer house was shifted to a spot, on the same mountain, more sheltered from these winds.

DRIFT MEASUREMENTS CONFORM TO STAR TIME

Miller found that the daily records of drift made during the day, at different seasons of the year, would not conform, when plotted as curves, to solar time abscissas and to either drift velocity or drift direction, as ordinates. When, however, they were plotted to star-time abscissas, they did conform much better. The difference between star time and solar time is roughly constant during any one day; but in the course of six months they swing apart by twelve hours. Miller's measurements have been going on from time to time since 1921, and he has been able to tabulate and plot very many of them. He showed moving pictures of a set of observations being taken at the sixteen points of azimuth on the interferometer table, the set being completed, by long practice, in about three minutes of time.

Miller refrained from giving any theory to account for the experimentally obtained results, which now seem to be consistent from 1887 to 1926. He evidently prefers to keep his mind free from any preconceived theories while he is accumulating observations. He indicated, however, that a certain small star-time or siderial-time component of the drift might be assigned to the earth's orbital speed, provided a nearly constant speed of at least 200 km. per second could be assumed through all the observations, in a direction of space not far from the pole of the ecliptic.

What then is the state of inferences to be drawn from all of the reported facts? In the first place, unless all of Miller's thousands of observations are unreliable, ether drift is apparent in interferometer measurements of light speed over the table in a laboratory. Consequently, the fundamental postulate of the Einstein theory is denied. On the other hand, the Einstein theory of space-time seems so well confirmed, both by external and internal evidence, that its support in the future seems assured. Here we find ourselves between the horns of a dilemma.

SPECULATIONS AS A RESULT OF TESTS

In this uncertainty a certain amount of speculation is permissible, although it is not known whether Professor Miller would approve of it. An observer on the earth's surface is subject to several simultaneous velocities. First, there is the velocity of rotation about the earth's axis, a mere matter of a few hundred meters per second, and therefore relatively insignificant in this inquiry. Second, there is the earth's orbital velocity, which, as we have seen, is about 30 km. per second. Third, there is the velocity of the whole solar system with respect to the Milky Way, or the stellar universe to which we belong. This velocity is estimated to be roughly 20 km. per second, directed approximately toward the constellation Hercules, according to astronomical estimates. Finally, there may be a much larger velocity of our universe with respect to more remote universes in space, estimated by some observers as perhaps 300 km. per second, directed perhaps toward the pole of the ecliptic, roughly, or toward the constellation Draco. If we assume such a velocity system as a speculation, not yet fully supported by astronomical authority, the orbital velocity of the earth would be a comparatively small component of the whole. At corresponding successive siderial times of the year, in any one locality, the orbital component of speed would repeat itself, and such curves for successive years would repeat regularly.

The Fitzgerald-Lorentz contraction of the moving electrons, forming the table, or interferometer base, might be expected to prevent any such velocity component or velocity system from being detected. A solid body might, however, be subject to constraints, that would

offer some resistance to this shrinkage. Instead of the full shrinkage being produced, possibly only 95 per cent of the full theoretical shrinkage is produced. In that case the interferometer would reveal 5 per cent of the impressed velocity. If the velocity system is, say, 200 km. per second in a fixed direction through space, plus the orbital 30 km. per second, directed successively around the earth's orbit, there would be revealed a steady drift of 10 km. per second, with a superposed orbital component of 1.5 km., which would change in direction annually with the seasons and vary daily with siderial time. Such a combination might fit Miller's curves. It would leave the Einstein conclusions substantially unchanged, not on the principle of relativity, but on the basis of the Fitzgerald-Lorentz electrodynamic distortion of moving atoms.

We shall have to wait for more observations, in various places, before we can feel reliance in any such speculation; but we have a right to hope that confirmation will come both to the Miller observations on the one hand and to the Einstein relativity conclusions on the other.

Power Factor and Production Cost

Comparison of American and European Practices—Suggestions for, and Cost of, Control in Supply System and on Consumers' Premises

By R. C. MUIR
Industrial Engineering Department, General Electric Company

INASMUCH as various articles have appeared from time to time in the electrical press dealing with the disadvantages of low power factor and with methods of correcting it, it may be interesting to examine the subject from a somewhat broader viewpoint than has been taken in many cases by other contributors.

One would have us follow European practice and virtually do away with the squirrel-cage induction motor; another believes the entire difficulty is due to overmotoring and attempts to prove that this factor alone represents an additional investment on the part of the public utilities of more than a quarter of a billion dollars and an annual loss of more than six billion kilowatt-hours; whereas another confuses the situation by making the motor-starting current the most prominent factor.

Many considerations are involved in the power factor, but, viewed broadly, it is not a difficult problem. The disadvantages have been grossly exaggerated and quite unreasonable conclusions as to the benefits of improved power factor have been reached by following a line of reasoning premised on theoretical assumptions rather than by considering the practical facts and the different solutions available to users of electric power.

Conditions Not Critical

The disadvantages of low power factor to the public utility and to the consumer are recognized, but conditions are not critical. We are confronted with an existing situation of low power factor, but, from the curve on page 1087 of the Nov. 21, 1925, issue of the Electrical World, it will be noted that the percentage of electrical energy lost in transmission is not increasing, notwithstanding the tremendous increase in industrial load and the greater length of transmission lines. In this respect, therefore, conditions are improving rather than growing worse, and the outlook is encouraging.

Recognition being given to the advantage of high power factor, which might be summarized as decreased investment in generators, transformers and transmission lines, decreased copper loss and improved voltage regulation, it is obvious that serious consideration should be given to obtaining as high power factor as is consistent with a proper balance between the savings involved and the investment required. It is also most important that a gain in power factor be not obtained by sacrificing some of the benefits of electric drive which have resulted in increased quality and quantity of production. The cost of electric power in terms of total cost of product is such a small item—usually less than 5 per cent, which, in turn, is affected but slightly by power factor—that any average industrial plant would find it much more profitable to increase the power bill materially than to decrease the production even slightly.

Choice of Motor Important

In considering the problem, one naturally investigates the cause of low power factor and finds that it is due to the magnetizing current required by alternating-current equipment, and that the induction motor, requiring approximately the same magnetizing current at all loads, is one of the principal potential sources of low power factor in an industrial plant. It follows that such motors, when operated at partial loads, have a high ratio of magnetizing current to energy current; consequently a low power factor. One of the obvious ways, therefore, of improving power factor is to operate all induction motors at all times at approximately full load.

In selecting induction motors for given applications, the first and most important requirements are that the motors chosen shall insure the most successful operation of the machinery they drive, that they shall be of as simple and rugged construction as possible and that they shall operate as nearly at full load as possible and at as high speeds as are practicable. Both of these last requirements result in improved power factor and efficiency. It is obviously to the interest of the user, the central station and the motor manufacturer that motors shall be so selected. Money spent on making correct applications will yield an excellent return.

Conditions are often encountered in industrial plants which demand very careful consideration in the choice of the motor best fitted for the application. It may be found that the machinery to be driven requires an abnormally high ratio of starting torque to running

torque, and under these conditions the starting torque required rather than the operating load may determine the rating of the motor selected. As an alternative to the standard squirrel-cage motor one may consider the use of an induction motor, which will give greater torque per ampere of starting current. This can be obtained by a special squirrel-cage rotor designed for high starting torque, or with a form-wound rotor. The choice of such a motor may be necessary in some cases due to imposed limitations of starting current, but the primary object is to obtain a better operating power factor than would be obtained with the standard squirrel-cage motor of the size required properly to start the load.

It is not safe to assume that the alternative motor, because it is operating at nearer full load, will have a power factor and efficiency better than the standard squirrel-cage motor run at the identical load. Before selecting an alternative motor, therefore, the power factors and efficiencies of the various motors at the actual operating load should be compared, then the relative purchase prices, costs of installation and costs of maintenance. It is only by such an analysis that the motor which will give the best service and at the best power factor can be selected. It is a problem of motor application and not of simply selecting the motor that will operate at most nearly its full load.

PRODUCTION GOVERNS DRIVES

Some emphasis has been laid on the higher power factors of group drive contrasted with individual drive. Here again it is a question of good engineering applied to motor applications. Neither form of drive is a panacea. The final decision as to the drive to use should properly rest on the one which has, for that particular job, the more important advantages from the user's production viewpoint. As previously pointed out, the advantages and disadvantages of various forms of electric drive must be judged by their effect on production and the value of the drive contrasted with the cost of accomplishing the result sought. It must be remembered that the cost of supplying needed magnetizing current is at most only a fraction of the cost of power, which in turn is only a fraction of the cost of the total production.

From the user's point of view, the best motor is that which has the greatest reliability, suitable characteristics as to torque and speed, and the highest efficiency. The squirrel-cage induction motor usually has these characteristics and is eminently suited to the needs of the industries for most applications. This, combined with its exceptionally low price, explains its popularity for industrial applications. Generally speaking, the squirrel-cage induction motor should be given first consideration for industrial applications. It is true that the use of large induction or synchronous motors, arranged for group drive, present the opportunity of taking advantage of the diversity factor of the individual machines and permit the use of a more nearly fully loaded motor and thereby give a higher power factor. However, most modern factories are recognizing that individual drive offers advantages in production, shop arrangement, over-all plant efficiency and operating efficiency which are far more important than power costs. The small squirrel-cage motor is, almost without exception, the most suitable for individual drive. Although the choice of the proper induction motor plays an important part in obtaining a suitable power factor for the plant at large and should always be given careful consideration, the major advantages of individual drive should not be overlooked in an effort to improve power factor by group drive with larger motors of the induction or synchronous type.

The average starting time of squirrel-cage induction motors is not more than five seconds, and although each motor requires several times normal current at a low power factor during the starting period, the time of starting is so short and the diversity factor of starting is so good that, if studied carefully, it will be found that the starting current is a very unimportant factor. The form-wound rotor induction motor takes a very much lower starting current at a fairly high power factor, and in Europe, where the power plants and the distribution lines have been low as compared with American plants, the form-wound rotor induction motor has been used extensively and squirrel-cage induction motors have been prohibited, except in very small sizes.

In the United States the electrical manufacturers have proceeded on the basis of making electrification of the industries as attractive as possible by offering the most reliable driving unit at the lowest possible price, and the public utilities have made the use of electrical energy as attractive as possible by offering the industries very attractive rates. European industries have been seriously handicapped because they have been compelled to purchase expensive motors, which at the same time were less reliable, demanded greater maintenance charges and operated at lower efficiencies. Surely in the United States, where our low production costs are largely dependent upon the extensive use of electrical energy, we do not wish to adopt the European motor practices. On the other hand, the tendency in Europe is to adopt American practice and the squirrel-cage induction motor.

SYNCHRONOUS MOTORS ADVOCATED

Although it may be assumed that the industries have done everything feasible in applying squirrel-cage induction motors with a view to obtaining high power factor and still further improvement would offer material advantages, it will be generally found that the synchronous motor, if applicable, will prove to be the most economical and effective means of bringing about the desired improvement. Marked improvement has been made in the starting characteristics of synchronous motors within the past few years, so that, in so far as starting is concerned, synchronous motors can now be considered for any application where squirrel-cage induction motors are satisfactory. The synchronous motor is of rugged construction, requires low maintenance and at the same time is a motor having an efficiency as high as or slightly higher than the squirrel cage induction motor.

Synchronous motors usually cannot be applied to advantage in capacities less than 50 hp., although certain applications can use synchronous motors to advantage in capacities as low as 25 hp. Many plants do not employ motors of these capacities, and existing plants may find it rather expensive to substitute such motors for those already installed. For such conditions, the capacitor or the synchronous condenser offers an efficient means of improving the power factor. The power factor problem, therefore, from the industrial point of view, is not a difficult one, but in its consideration reliability, maintenance, shop arrangement, production and other major advantages must not be overlooked.

The consumer will continue to use the motor that

gives him the greatest production at the lowest cost—the squirrel-cage induction motor; he is learning to apply these motors so as to obtain the highest power factors consistent with service conditions, and he will use synchronous motors and power factor improvement equipment where the increased expenditure is warranted by better operating conditions, savings within the plant and lower power rates.

MEETING THE CONSUMER HALF WAY

From the point of view of the public utility, it is only fair to ask the consumer to pay for reactive magnetizing current as well as active kilovolt-amperage. The general tendency is to sell the industry what it wants and charge accordingly, making it an incentive, however, to maintain a high power factor. There are certain advantages in meeting a consumer half way in this matter of power factor, as the installation of power factor improvement devices at the main distributing substation of the electric utility provides an economical means of giving good voltage regulation and places in the hands of the electric utility the control of economic loading of the main distribution lines, transformers and generators. Aside from the advantage of keeping the control of these factors in its own hands, the electric utility can provide a certain amount of power factor improvement at a lower first cost than can the consumer. Reactive kilovolt-amperage costs the electric utility a certain amount, but this amount should be based upon what it would really cost by the judicious use of synchronous condensers and capacitors rather than on the cost based upon increasing generator, transformer and line capacity sufficiently to take care of the load at whatever the power factor might happen to be. For example, a public utility might find that the most economical power factor for its particular system is 0.95, while the existing power factor is 0.7. Increasing the generating, transforming and line carrying capacity 36 per cent might readily cost $100 per kilowatt load, but synchronous condensers could be installed to bring about this desired improvement at from $5 to $10 per kilowatt load* and at the same time would offer the advantages heretofore mentioned—namely, improved voltage regulation and a better control on the economical loading of the generators, transformers and lines.

OBLIGATION OF THE ELECTRIC UTILITY

Considering the entire power system, however, the installation at the main distributing substations of synchronous condensers of sufficient capacity to bring about all of the improvement in power factor does not represent the best solution of the problem from an economic or operating standpoint, as the secondary distribution system would still be operating with excessive line loss and voltage drop. The obvious answer to this problem is that the electric utility should make it attractive to the power consumer to improve the power factor to a point, probably between 0.8 to 0.9 power factor, where the secondary distribution system may be operated economically and without excessive line drop, and to improve the power factor from this point up to the desired figure by the installation of synchronous condensers at the main distributing substations.

Electric utilities must be careful in their rate making not to allow more for improved power factor than it really is worth to them and not to charge more for lagging reactive kilovolt-amperage than it would cost to compensate for it by the installation and operation of synchronous condensers. The power factor problem is a more difficult one than for the consumer, but progress is being made, and we can look forward to general improvement and a better understanding between electric utility and the consumer in this matter.

*One kilovolt-ampere in condenser capacity will improve the power factor of 1.45 kw. load from 0.7 to 0.95. Synchronous condenser installations will represent an approximate investment of from $7.50 to $15 per kilovolt-ampere, depending upon the size of the installation, whether or not transformers are necessary and other variable factors.

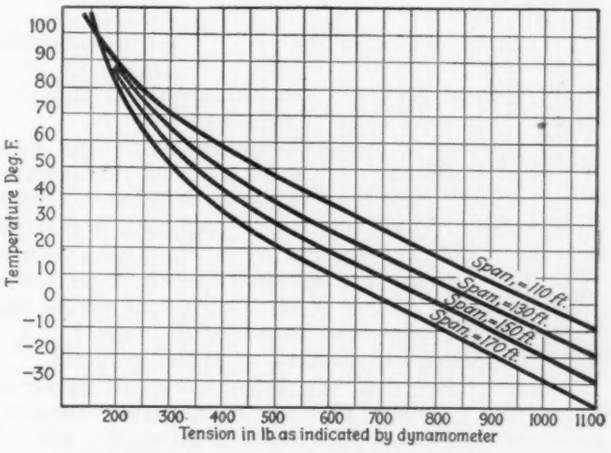
Stringing Tensions for Unequal Spans

Equation for "Equivalent" Span Which Furnishes Base for Fixing Tension Value—Distinction Between Average Span and Equivalent Span

BY ALFRED STILL
Professor of Electrical Design Purdue University

WHEN stringing overhead wires, it is customary to pull up a number of spans at one time, the proper tension as recorded on the dynamometer being that calculated for one particular length of span and the particular temperature at which the work is carried out. This method is entirely satisfactory when all the spans in the section are equal, but the calculation of the proper tension in the wire at the time of stringing is less simple when the spans are not all of the same length.

Consider, first, a line with unequal spans and wire tied securely to pin-type insulators. If we could string



TENSION-TEMPERATURE CURVES FOR SPANS

the wires under weather conditions which will stress the material to the safe working limit, it would be correct to pull the wire to this particular tension and then tie securely at each insulator. It should be noted, however, that with removal of the additional load, with or without change of temperature, there will be unbalanced pulls tending to bend the insulator pins unless the spans are all of the same length. There is one exception to this statement—namely, that at a particular temperature, which the writer has elsewhere* referred to as the "critical temperature," the tension in the unloaded wire will be the same in all spans irrespective of their length. This particular temperature is that at which the unloaded wire, hanging in still air, will have a sag equal to the maximum deflection of the loaded wire under the

*Refer to article "Sags and Tensions of Overhead Conductors," ELECTRICAL WORLD, Vol. 59, page 1021, May 11, 1912.

specified conditions which produce the maximum safe stress in the material. This "critical temperature" may be calculated by the formula

$$t_c = \frac{S_m}{Ea}\left(1 - \frac{w}{W}\right) + t_o \qquad (1)$$

where S_m = Maximum stress in the material (pounds per square inch)
E = Modulus of elasticity
a = Temperature-elongation coefficient
w = Weight per foot of unloaded wire
W = Total load per foot of wire, including wind pressure and ice (if any)
t_o = Temperature at which maximum load occurs.

The accompanying figure refers to a particular transmission line, and gives tension-temperature curves for different lengths of span. The "critical temperature" in this case is about 98 deg. F., and if the wire were strung at this temperature, it would be a matter of indifference whether or not the spans were all of the same length. When stringing at any other temperature, the question arises as to which of the several curves will indicate the correct tension at which to pull up the wires when the spans in a particular section are not all of the same length.

If we admit that a small lateral movement in the direction of line is possible at points of attachment—such as actually occurs when the suspension type of insulator is used—the tensions in the consecutive spans of unequal length will be approximately the same at all temperatures. The relation among tension P, span l and sag s is

$$P = \frac{wl^2}{8s} \qquad (2)$$

where P is in pounds, l and s in feet, and w is the weight, in pounds, per foot length of wire.

Any tendency to unbalance the pull on the two sides of a point of attachment will simply cause this point to move until the ratio $l^2 : s$ is the same in all the spans irrespective of length. It is thus seen that, in a series of spans of different lengths, but in which the points of suspension intermediate between the two strain tower attachments are capable of small horizontal motion, the tension in the wire—and therefore the ratio $l^2 : s$—will be approximately the same at all temperatures.

Imagine, now, that the actual series of spans is replaced by a number of spans all of the same length, such that the total length of wire in the suction and the tension at any particular temperature are the same as in the actual arrangement. The important difference between the imaginary series of "equivalent" spans and the actual series is that, since the equivalent spans are all of the same length, there will be no movement of the point of attachment with change of temperature (and stress). The intermediate points of support may therefore be considered fixed in position, and calculations based on a single "equivalent" span may be used for determining stringing tensions which will apply not only to the series of imaginary "equivalent" spans but to the actual arrangement also.

In an article published in the ELECTRICAL WORLD of April 9, 1921 (Vol. 77, page 812), M. J. Idail points out that the average length of span in the section is not the same as the "equivalent" when the spans are unequal, and he proposes an empirical formula by which the length of the equivalent span may be calculated within limits of accuracy which he has found sufficient for practical purposes. The following development, based on the preceding arguments and the formulas of the parabola, leads to an expression for the equivalent span which is quite as easy to use as Mr. Idail's empirical formula:

Calculation of Equivalent Span.—Given a wire of weight w lb. per foot, suspended horizontally between two points l feet apart, the length of wire in the span is

$$\lambda = l + \frac{w^2l^3}{24P^2} \qquad (3)$$

where P is the tension in the wire (pounds).

The total length of wire in a section consisting of several spans of lengths $l_1 l_2 \ldots$ etc., will be

$$\lambda_1 + \lambda_2 + \ldots \text{ etc.} = \Sigma l + \frac{w^2}{24P^2}\Sigma l^3$$

It is assumed that slipping at points of attachment is possible, or that suspension type insulators are used, permitting the small lateral movement of the points of support which will occur with changes of temperature if the spans are of unequal length. Consider the actual arrangement of spans to be replaced by a series of n_e "equivalent" spans all of the same length l_e. At any given temperature, the total length of wire in the section and the tension in the wire must be the same as in the actual series of spans, a condition which is expressed by the equation

$$n_e\lambda_e = n_e\left[l_e + \frac{w^2l_e^3}{24P^2}\right] = \Sigma l + \frac{w^2}{24P^2}\Sigma l^3$$

Note that $n_e l_e = \Sigma l$, which reduces the equation to a simple form from which the length of the equivalent span is seen to be

$$l_e = \sqrt{\frac{\Sigma l^3}{\Sigma l}} \qquad (4)$$

This is the length of span which should be used for calculating the stringing tension at various temperatures. If the wires in the section consisting of several unequal spans are pulled to the tension indicated by these calculations, they will not be overstressed when the weather conditions are such as to produce the specific or assumed maximum load.

The use of the average span in these calculations is incorrect, although with small differences of length among individual spans the error is not of any practical importance. Moreover, with very great differences of length in adjoining spans, it is customary to dead-end the wires at the junction of the two spans, so that an exact formula for the "equivalent" span is not often needed. The following numerical example shows that there may be an appreciable difference between the average and equivalent span lengths.

Consider four spans in the dead-ended section, of lengths 300, 300, 800, and 400 ft. respectively. The average length of span is 450 ft.; the equivalent length calculated by formula (4) is 592 ft., and the length calculated by Mr. Idail's empirical formula is 683 ft.

Hevi Duty Furnace in French Plant

A BRASS annealing furnace at the plant of the French Manufacturing Company, Waterbury, Conn., was depicted in the ELECTRICAL WORLD for Jan. 23, page 199, and the installation was credited to Westinghouse origin. The Westinghouse company sold the furnace, but the designer and manufacturer was the Hevi Duty Electric Company, Milwaukee, owner of the patents under which this furnace and the heating coils therein were marketed.

FIG. 1—ELMER AVENUE IN BUFFALO SHOWS HOMES USING ELECTRIC RANGES

Is Our Range Load Profitable?

Buffalo General Electric Company Answers, "Yes"—Facts and Figures on Costs and Performance Show Good Returns from Range Business—Detail Data Submitted

By ROSCOE MACMILLAN and FRANK A. COUPAL
Statistician and Sales Manager, respectively,
Buffalo General Electric Company

The officials of the Buffalo General Electric Company have consented to the publication of costs and returns on the electric range business because of the benefit the industry can receive from the detailed studies made on their system. Under competitive conditions with natural gas, richer in British thermal units than artificial gas and which is sold for 65 cents, and a low electric rate of less than 2.75 cents this company finds the range business profitable. A rigid cost analysis is made which gives an investment charge of $173.32 per range, an annual operating cost of $21.98 per range and an annual gross revenue of $51 per range. The investment charges are a maximum in that they are made on a peak-load basis for all parts of the system. These data and experiences should prove very valuable to all utilities. They supplement the Range Survey Report of the N.E.L.A. and afford additional data to show that the electric range is good business for the light and power industry.

—The Editors.

SINCE 1914 many electric public utilities have contemplated with considerable apathy the electric range as a profitable revenue-producing appliance. Several companies, however, have made determined efforts to place upon their lines a sizable range load, prompted principally by a hope that such a load would be both desirable and profitable.

It is now generally recognized that electric utilities must soon look to increasing the kilowatt-hour use by customers rather than new-business connections for a satisfactory growth of central-station business. The electric range is the outstanding large-using kilowatt-hour electric appliance of the moment, and those who have used electric ranges within the last five years can bear splendid testimony to the real practical advantages of such an appliance in the home.

Consideration of the annual average residence lighting bill of from $22 to $25, with the possibility of raising these figures to from $45 to $60, should certainly interest the electric utility to investigate the value of electric ranges as load builders.

From 8 to 10 per cent is regarded as the natural annual increase of residence service without intensive sales methods. Certainly a 100 per cent increase of gross revenue should claim a most careful analysis of possibilities and profits. With this in mind, the authors of this paper have made careful investigation of the question, "Is our range load profitable?"

Several years ago, when it was decided to encourage the use of electric ranges on the lines of the Buffalo General Electric Company, it seemed reasonable to assume that the customer would offer less sales resistance to an increased use of electric service billed on one invoice for all electric service rendered at his residence. The following rate still proves very satisfactory, as is evidenced by the high annual kilowatt-hour use of 682 kw.-hr. per residence customer:

Six cents per kilowatt-hour for the first 60 hours average monthly use of the maximum demand.

Four cents per kilowatt-hour for the next 120 hours average monthly use of the maximum demand.

One and one-half cents per kilowatt-hour for all current consumed in excess of 180 hours average monthly use of the maximum demand.

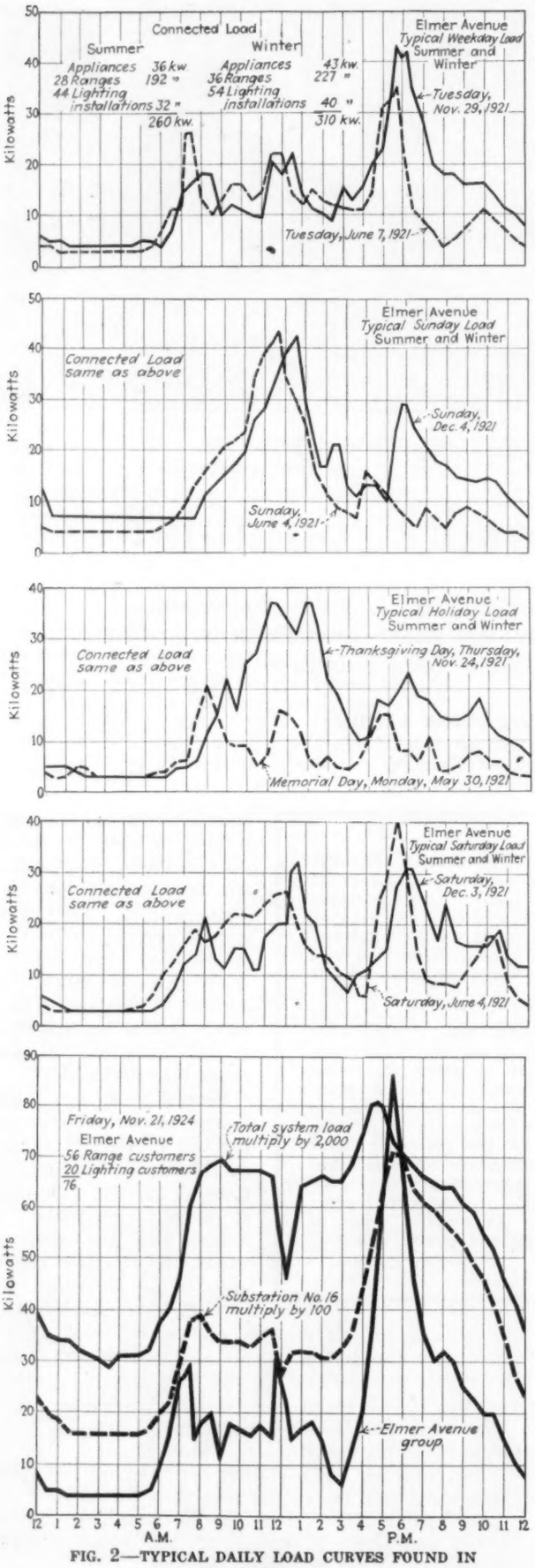


FIG. 2—TYPICAL DAILY LOAD CURVES FOUND IN THE 1921 TESTS

The total installation is determined by an actual inspection of the premises. The maximum demand is computed in two parts:

1. Twenty-five per cent of the total lighting installation. Never less than 250 watts.

2. Two and one-half per cent of any electric ranges, hot plates, sterilizers, electric water heaters or other appliances of 1,000-watt capacity or more.

Irons, heating devices, other cooking devices, fans, vacuum cleaners and small utility motors not exceeding ½ hp. are not counted in determining the maximum demand. On motors over ½ hp. but less than 1 hp. the maximum demand is taken as 25 per cent of the rated capacity. A discount of one cent per kilowatt-hour on the consumption billed at the six-cent rate is allowed for prompt payment and a minimum bill of $1 per month is collected.

During the year 1925 our residence customers using electric service for lighting, small appliances and an electric range had an average kilowatt-hour consumption of 288 per month and an average monthly bill of $5.80.

Mixed, natural and manufactured gas is supplied plentifully in Buffalo at 65c. per 1,000 cu.ft. and proves a very active competitor in the field of domestic cooking.

TESTS MADE ON RESIDENCES

For a test a group of residences was selected in 1921, of which approximately 40 per cent had electric ranges

Table I—Analysis of Investment and Operating Costs for Range Loads

Tabulation of Kilowatt Values

	Kw.
Maximum load of group	82
Group load at time of substation maximum	82
Group load at time of substation maximum as measured at substation	89.5
Plus 10 per cent loss in substation	98.5
Plus 2 per cent loss in cables	100.5

The load at the time of the annual peak (4:45 p.m.) is 50 kw. Allowing losses as above, this will be 61.5 kw. at the generating station.

Investment Costs	Cost per Customer
Meters: Average cost of meters and service boxes for the entire group	$17.70
Services: Average cost of service wires in place for the entire group	9.21
Secondary lines: Average cost of secondary line in place for entire group	11.01
Transformers: Cost of five 25-kw. transformers reduced to average per customer	17.75
Poles: Investment in poles was apportioned on the basis of the investment per kilowatt of maximum on the entire system applied to the group demand at the time of annual peak	4.61
Primary lines: For that part on Elmer Avenue, we measured the length of wire and calculated its cost in place	1.16
For the primary circuit back to the substation the pounds of copper in the circuit and the maximum load of the circuit was computed in pounds of copper per kilowatt of circuit maximum. This was applied to the group load at the time of the substation peak and was reduced to a cost per customer	10.13
Substation investment: The investment per kilowatt of maximum output was applied to the group load at the time of substation maximum and was reduced to a cost per customer	23.75
Transmission cables and conduits: This investment per kilowatt of annual peak of system was applied to the group load at the time of annual peak and was reduced to a cost per customer	22.50
Steam plant: The investment of plant per kilowatt of annual peak of system was applied to the group load at the time of the annual peak and reduced to a cost per customer	33.00
Miscellaneous tangible capital: This account includes investment in office building and other general structures, office equipment, engineering expenses and other general construction expenditures and was apportioned to a cost per kilowatt of annual peak of system and then applied to the group load at the time of annual peak and reduced to a cost per customer	22.40
Total investment per customer	$173.22

(*Table I continued on next page*)

Table I—Analysis of Investment and Operating Costs for Range Loads (Continued)

Operating Costs

	Cost per Customer
Energy costs: The actual measured kilowatt-hours of the group tested was applied to the operating costs per kilowatt-hour of our steam plant service and our hydro service and then further apportioned as a cost per customer	$9.43
Transmission expense: This is the expense of operating transmission lines and cables and amounts to 68 cents per customer on our entire system. This same expense is used for the group	.68
Expense of operating terminal house: This expense per kilowatt of annual peak is applied to the group demand at the time of the annual peak and reduced to a cost per customer	.32
Substation expense: This expense per kilowatt of substation peak is applied to the group demand at the time of the substation peak and was reduced to a cost per customer	1.16
Distribution expense: Superintendence, maps and records, office expense, setting and removing meters and transformers are all apportioned on the basis of the total number of customers on the entire system and amounts to 97 cents per customer, which is used for the group	.97
Repairs to poles: This expense is apportioned on the basis of cost per kilowatt of annual maximum and applied to the load demand of the group at the time of the annual peak, which reduces to a cost per customer	.29
Overhead line repairs: This account is apportioned on the same basis as repairs to poles above and amounts to 30 cents per customer	.30
Repairs of service wires: These repairs are apportioned on the basis of the total customers on our entire system at 22 cents per customer	.22
Transformer repairs: This expense is apportioned on the basis of total transformers on our system applied to the number of transformers used for the group and reduces to a cost per customer	.05
Meter operating and repairs: This account is apportioned on the basis of the total meters on our entire system at 83 cents per customer	.83
Rental of poles: This account is apportioned on the basis of total customers on our entire system at 7 cents per customer	.07
Utilization expenses: This account covers the cost of inspection and repairs of consumers' installations. It is apportioned on the basis of the total customers on our entire system at 80 cents per customer	.80
Commercial and promotion expense: This account includes expenses of reading meters, billing, collecting and new-business expenses and is apportioned on the basis of the total number of customers on our entire system at $2.45 per customer	2.45
General and miscellaneous expense: This account includes salaries and expenses of general officers, general office clerks, law expenses, insurance, accidents and damages and the operating expenses of automobiles and storeroom expenses. This account is apportioned on the basis of the total customers on our entire system at $4.41 per customer	4.41
Total operating cost	$21.98

Conclusion

Revenue from group for 1924 per customer	$51.00
Total operating costs as above per customer	21.98
Amount available for fixed charges on investment costs of $173.22 per customer	$30.02

The sum of $30.02 is equivalent to 17.3 per cent of $173.22. If fixed charges are assumed as 7 per cent for interest, 5 per cent for depreciation and 2.7 per cent for taxes, a total of 14.7 per cent, there will be available for surplus 2.6 per cent.

and which were located in a section where no industrial load exists. These houses were very similar in construction, costing approximately $7,000 each, fairly representing an average residence in the city of Buffalo.

Service was supplied from one end of the street by an overhead line on the west side with service wires fanning out to both sides of the street. All services are connected to a heavy secondary line running the entire length of the street, being fed through five 25-kva. distribution transformers located in the vicinity.

Measuring instruments were cut in on the primary line where it entered the street, thus confining the measurements taken to the strictly residential business. The kilowatt input on this primary line was measured with graphic instruments during a summer period and also during a winter period in 1921. The use of service by these customers was carefully checked for changes until November, 1924, when the graphic

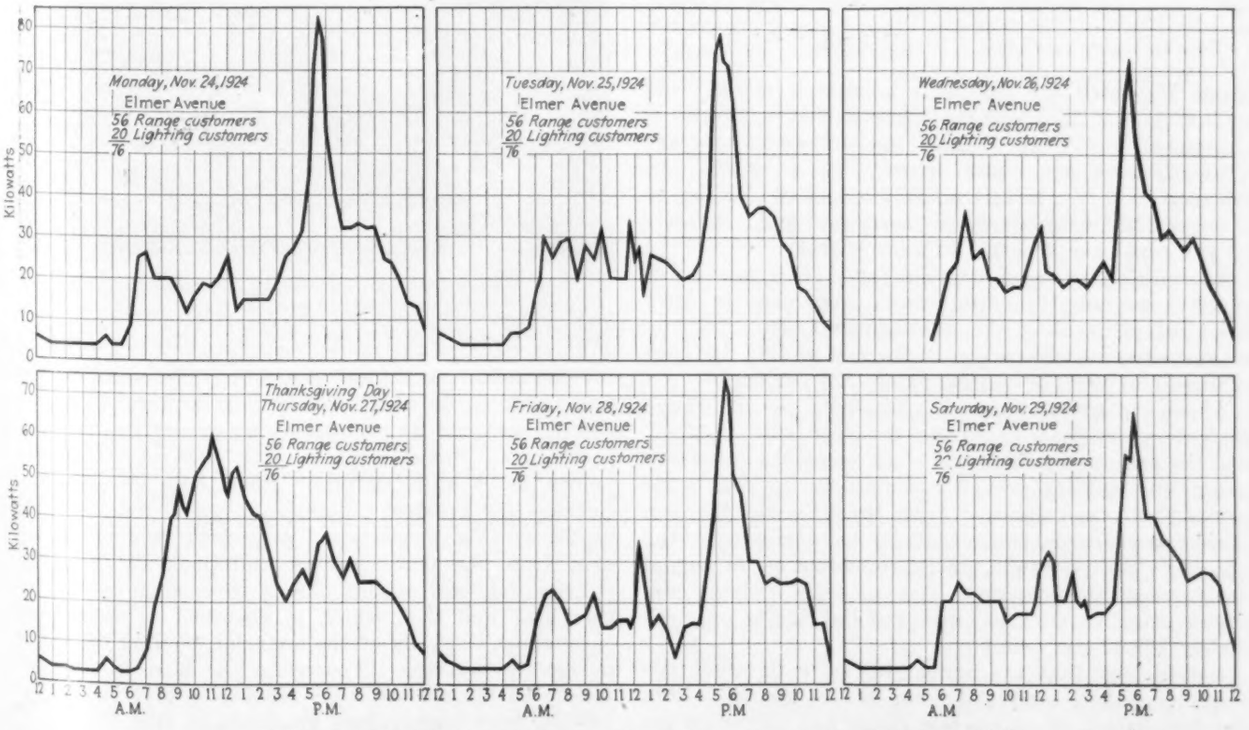


FIG. 3—A WEEKLY LOAD CURVE FOR RANGE AND LIGHTING CUSTOMERS IN 1924

instruments were again put in place and additional readings taken. The charts for 1924 and 1921 show very similar characteristics.

In making the accompanying analysis it seemed best to approach the problem from the viewpoint of ascertaining the investment cost and operating cost per customer. With variation in results the items selected for computation may be applied to any other electric public utility.

The system of the Buffalo General Electric Company is a combination of hydro power purchased from Niagara Falls under long-term contract and steam power generated in a modern steam plant, the general condition being such that any additional power requirements must be provided for by additions to the steam plant.

The costs were considered under two heads: Investment costs and operating costs. The calculation of these costs was made as shown in Table I.

Although the conclusion arrived at in the table seems a satisfactory answer to the question, "Is our range load profitable?" the following statistics show that the revenue of $51 per customer per year is less than the average for our entire system.

Since 1921 the customers of the Buffalo General Electric Company have enjoyed two rate reductions made voluntarily by the company affecting residence rates in particular. In spite of these reductions in rate, the assumption that range users will continue to increase their use of electric service is justified by the data in Table II, which are applicable to electric range users in Buffalo, not including the users of electric ranges in apartment buildings. Note the increased average kilowatt-hours per month from 1921 to 1925. An advance from an average monthly use of 214 kw.-hr. to a use of 288 kw.-hr. shows an increase of approximately 35 per cent over a period of four years.

TABLE II—STATISTICS OF INDIVIDUAL ELECTRIC RANGE USERS IN BUFFALO

(No Apartment Houses Included)

Year	Total Kw.-Hr.	Net Bill	Monthly Average Kw.-Hr.	Average Rate Cents	Average Bill
1921	4,477,867	$123,974.01	214	2.77	$5.94
1922	6,506,704	181,276.96	213	2.79	6.03
1923	8,411,977	219,930.91	233	2.62	6.12*
1924	9,954,998	262,046.80	233	2.63	6.13
1925	10,493,356	226,965.03	288	2.54	5.80*

*Rate reductions made Jan. 1, 1923, and Feb. 1, 1925.

In addition to the figures in Table II, it may be of interest to note that the range customers in 1921 used 10½ per cent of the total kilowatt-hours used by all residence customers and at the end of 1925 the percentage had risen to approximately 12½ per cent.

Since the average monthly bill paid by the range customers listed above during the year 1925 is $5.80, and the average monthly bill of all residence customers using only lighting service averages during that same period $1.87, the balance of $3.93, the difference between these two averages, can reasonably be attributed to the use of an electric range, which, computed on an annual basis, means that the gross revenue from a single consumer using an electric range and lighting is approximately $69.60 per annum.

Considering that the annual bill of a lighting customer is $22.44, computed from figures already given, the installation of an electric range has increased the annual revenue per customer approximately 200 per cent.

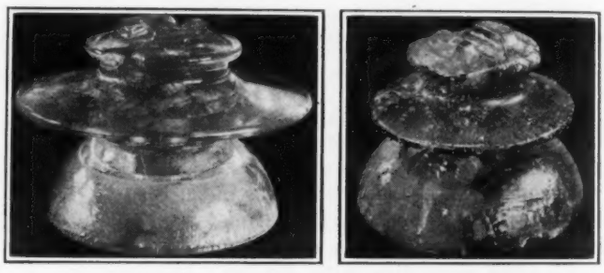
Power Arc Tests on Insulators

Porcelain and Pyrex Insulators Tested—Analysis of Results Shows Pyrex Has Good Characteristics—Use 1,800 Amp. Under Maximum Conditions on 6.6-Kv. Line

BY J. T. LITTLETON* AND L. C. NICHOLSON†

IT IS well known that many interruptions of power service are caused by insulator failures due to power arcs over the insulators. It is possible that measurements of the current in power arcs sufficient to break porcelain insulators may have been made under conditions similar to those in service, but the writer has not been able to find any published results of such tests. Accordingly it seemed desirable to make such tests on both Pyrex and porcelain insulators, as these materials are very different in some of their properties and it was possible that there might be a considerable difference in their ability to withstand power arcs under known line conditions.

The ability of a material to withstand a power arc will depend upon the thermal coefficient of expansion of the material, mechanical strength under compression and tension, the coefficient of heat transmission, the specific heat and its heat-absorbing properties from the power arc. Some of these properties of Pyrex are known to be quite different from those of porcelain. Perhaps the greatest difference exists in their relative heat-absorbing properties. A certain portion of the heat from the power arc is radiation; Pyrex, being transparent, will absorb only a very small portion of this heat and that which is absorbed is distributed throughout the body of the material, tending to heat it uniformly, whereas in porcelain the heat is absorbed mostly on the surface, thus tending to give rise to extremely high-temperature gradients in that region.



APPEARANCE AFTER POWER ARC TESTS

Fig. 1 (at left)—A 44,000-volt Pyrex insulator after an 800-amp. five-second power arc test.

Fig. 2 (at right)—A 25,000-volt Pyrex insulator tested at 1,800 amp. for five seconds.

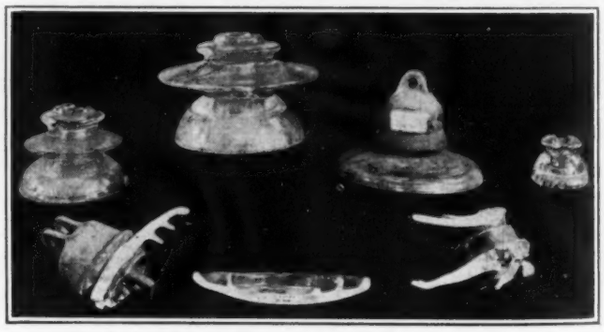


FIG. 3—GROUP ASSEMBLAGE OF INSULATORS TESTED AT 800 AMP. FOR FIVE SECONDS

*Research engineer Corning Glass Works, Corning, N. Y.
†Consulting engineer Niagara, Lockport & Ontario Power Co.

The equipment of the Niagara, Lockport & Ontario Power Company at the Gardenville substation was used in making the tests. A bank of 10,000-kva., 66-kv. to 6.6-kv. transformers was used. The primary was connected directly to the 66-kv. bus supplied from Niagara Falls. The secondary was connected to the test insulator in series with a loop of transmission line, the Olean 66-kv. line being used for this purpose. The resistance of the transmission-line loop was changed to get the three values of current used, by placing a short-circuiting jumper between phase wires at different places along the line. The actual current flow was read

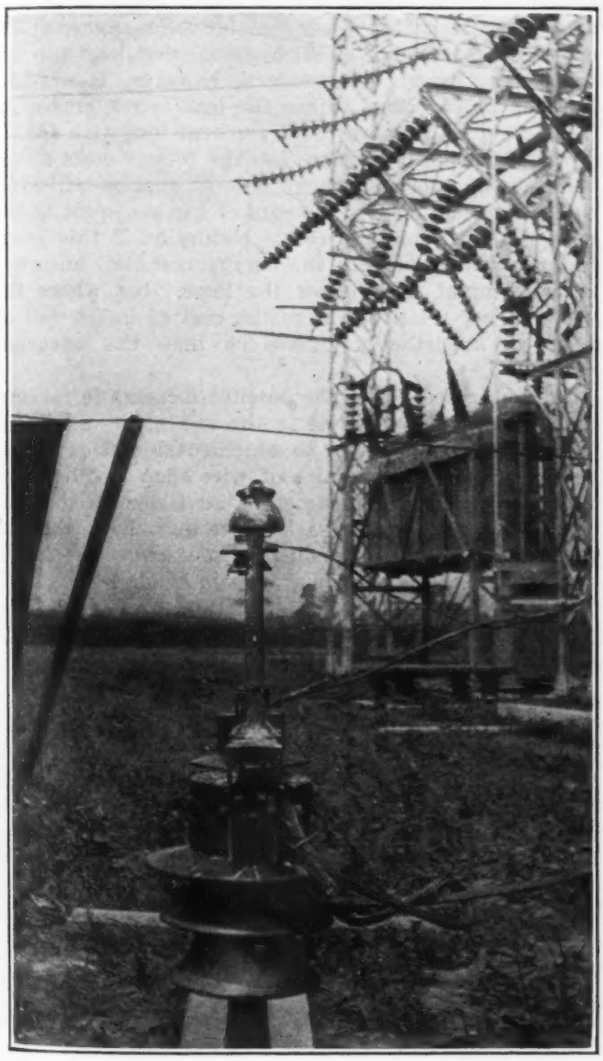


FIG. 4—A 6,600-VOLT PYREX INSULATOR IN POSITION AFTER BEING TESTED FOR FIVE SECONDS AT 1,800 AMP.

on the station ammeter. There were three values of current used in the tests—namely, 500 amp., 800 amp. and 1,800 amp. The 500-amp. and 800-amp. currents were obtained from two of the 6.6-kv. transformers in series, giving 13 kv. on the line. The 1,800-amp. current was from three of the 6.6-kv. transformers connected in parallel. There was no measurement of the voltage of the arc itself, but a portion of the secondary voltages was absorbed by the impedance of the transformers and the transmission line, etc. In any event, the transformer voltages (13 kv. and 6.6 kv.) were high enough to maintain the arc satisfactorily.

The time of the arc was five seconds except in some tests at 1,800 amp., where the time was reduced to two seconds.

The Pyrex insulators that visibly passed the power arc test were tested in air with high-potential current for puncture.

The insulators were mounted as in service—that is, pin-type insulators with standard pins, cable and tie wire, suspension insulators with standard cable connections both in the horizontal and vertical positions. The tests, of course, were made out of doors, consequently large canvas windshields were installed to prevent wind blowing the arc away from the insulator.

The insulators as mounted were then short circuited with a fuse of No. 28 copper wire, the wire being drawn tight over the insulator and under the skirt to the terminal, where it was fastened. The switch was then closed and the circuit breaker was held down for the desired interval of time; then the circuit was broken.

The accompanying table gives the results of the tests on insulators.

TABLE I—TEST RESULTS ON INSULATORS

No.	Insulator	Arc. Amp.	Time, Sec.	Condition	Dry Flash-over, Kv.
1	Porcelain 45,000	500	5	Badly broken	...
2	Porcelain 6,600	500	5	Badly broken	...
3	Telephone glass	500	5	Badly broken	...
4	Porcelain 60,000	500	5	Broken skirts	...
5	10-in. suspension porcelain	500	5	Broken skirts	...
6	Pyrex 25,000*	500	5		...
7	Pyrex 25,000	500	5		...
8	Pyrex 6,600	500	5		...
9	Pyrex 44,000	500	5	..Surface glaze checked...	...
10	Pyrex 44,000	500	5		...
11	Pyrex 10-in. suspension*	500	5		79
12	Pyrex 10-in. suspension	500	5		...
13	Porcelain 45,000	800	5	Badly broken, porcelain fused	...
14	10-in. suspension porcelain	800	5	Badly broken, porcelain fused.	...
15	Pyrex 6,600	800	5	Glaze checks	52
16	Pyrex 25,000	800	5	Glaze checks	110
17	Pyrex 44,000	800	5	Glaze checks	136
18	Pyrex 10-in. suspension	800	5	Glaze checks	78
19	Porcelain 45,000	1,800	5	Badly broken, porcelain fused	...
20	Porcelain suspension	1,800	5	Badly broken, porcelain fused	...
21	Pyrex 10-in. suspension	1,800	5	Glaze checks, insulator vertical arc did not hold	66
22	Pyrex 10-in. suspension	1,800	5	Insulator horizontal, disk badly broken	...
23	Pyrex 25,000	1,800	5	Petticoat cracked	...
24	Pyrex 25,000	1,800	5	Badly cracked, but did not fall apart	...
25	Pyrex 44,000	1,800	5	Badly cracked, but did not fall apart	...
26	Pyrex 6,600	1,800	5	Badly cracked, but did not fall apart	...
27	Porcelain suspension	1,800	2	Badly broken	...
28	Pyrex 44,000	1,800	2	Glaze checks only	...
29	Pyrex 10-in. suspension	1,800	2	Glaze checks only	60
30	Pyrex 44,000	No power arc tests			136
31	Pyrex 25,000				113
32	Pyrex 6,600				53
33	Pyrex 10-in. suspension				100

* Test repeated on insulator with same result.

The Pyrex insulators after going through the test showed the very peculiar characteristic common to all of the insulators tested—that is, over the areas of the surface on which the arc directly played there was a glaze formed that was checked up like an old paint surface. The photograph shown in Fig. 2 is a good illustration of this effect. This glaze is easily scraped off, leaving a solid body beneath with no signs of any bad effect. Apparently the insulator will still continue to function, for in several cases the tests were repeated on the same insulators, the repetition merely serving to give more checks but otherwise not affecting the insulator. It was apparent from the appearance of the insulator that the dielectric properties of the Pyrex insulator had not been materially weakened by the test except in the case where the insulator was actually broken. The high-potential flashover tests confirm this conclusion. The decrease in flashover value is due to the conducting material deposited on the upper portions of the insulator,

and in no case did puncture of the insulator take place during puncture tests.

In Fig. 2 is shown the 25-kv. Pyrex insulator after it has been through the 1,800-amp. five-second test. Fig. 1 shows the results of the tests at 800 amp.

The high current arc—that is, the 1,800 amp. for five seconds over the small 6,600-volt Pyrex insulator—was particularly interesting. This insulator was completely covered with a metallic deposit, and although badly cracked held its shape and was photographed in position after the test.

It was further noticed during the test that porcelain insulators seemed to break very soon after the application of the arc. Although the light was so intense that no details could be observed, the sound of the falling porcelain occurred very soon after the arc started.

The general conclusions to be made under the conditions of the test are that the Pyrex insulator stands about four times as much power in the arc as the porcelain insulators do, for the breakage on the 1,800-amp. arcs on Pyrex was perhaps about equivalent to that of 500 amp. on the porcelain.

Letters from Our Readers

More Comment on Economical Size of Lighting Secondaries

To the Editor of the ELECTRICAL WORLD:

There was a very interesting article in the Feb. 27 number of the ELECTRICAL WORLD on "Economical Wire Size for Lighting Secondaries." As this article appears to upset somewhat previous theories in regard to the determination of economical wire sizes, I should like to call attention to one or two points in regard to it.

The author bases his computations on a theoretical cost which he calls unearned revenue, which is the revenue which might be received if no voltage drop existed in the secondary mains. While there would be no doubt an increase in the load if the customers' voltage were raised by decreasing the secondary voltage drop or by any other means, it would seem that the economic advantage shown is rather overstressed in this article. The author assumes that the "unearned revenue" is so much greater than the cost of losses that the latter becomes insignificant. By the same token the economical size of secondary wire would be very much larger than that obtained by Kelvin's law or other study of losses versus fixed charges.

In any attempt to draw general conclusions from a study of specific cost figures great care must be taken that these cost figures are of general application. In this case a net return of $0.07 per kilowatt-hour for this additional lighting load is assumed. This would seem to be a much higher figure than would generally be justified. The additional load is of the same nature as an additional lamp on a customer's service. It does not increase the load factor, but it enters into the peak load and must bear all demand and operating charges of any other peak load, except commercial expense, billing, metering, etc., whereas the return received is at the lowest rate if on the step-rate basis.

As an example, assume a system with 3 per cent secondary drop, which is a quite common economical condition. If the secondary is increased so that the drop is only 2 per cent, the increase in wire cost is 50 per cent. The 1 per cent increase in voltage causes an increase in wattage at the plant of the customer of approximately 1½ per cent (since the wattage increases, as $[1.01]^{1.6}$), but for distributed load the average increase for the line would be only three-quarters of 1 per cent. If the load factor is 25 per cent and the loss factor 10 per cent, the total increase in kilowatt-hours is $\frac{3}{4} \div 2\frac{1}{2} = \frac{3}{10}$ of 1 per cent, and the credit for this must be taken at the rate of the net profit on energy at the lowest step of the step rate.

Similarly, consider a comparison between losses and unearned revenue. For a 3 per cent loss at full load with the voltage drop to the end of the secondary about 3 per cent, the unsold kw. at peak load due to this drop is approximately 5 per cent for the customer at the end of the secondary. With distributed load the average for the whole secondary, however, is one-half that, or 2½ per cent. Since the loss factor applies to both, we may compare the 3 per cent loss with the 2½ per cent unearned revenue; but the former costs at the full rate of average energy cost at that point, while the latter costs only at the rate of the net profit at the lowest step of the step rate. Naturally, if this profit is large compared with the energy cost, the unearned revenue might overshadow the losses, but where the profit is not relatively large the cost of losses will be fully as important or more so than the unearned revenue.

It would appear that the possible increase in revenue to be obtained by a raise in the minimum voltage on the secondary is a factor to which consideration should be given, and a larger size of wire than would otherwise be used may sometimes be advisable on that account; but in its consideration care must be taken that its true relationship to other cost factors be clearly understood for the particular case in hand.

Detroit Edison Company,
Detroit, Mich. HOWARD P. SEELYE.

Specifications for Creosoted Yellow-Pine Poles

To the Editor of the ELECTRICAL WORLD:

The article "How Pole Consumer Can Benefit Himself," which appeared in your Dec. 19 issue (page 1245), offers much valuable information. However, we feel that the discussion of creosoted yellow-pine poles is apt to be misleading because of its restricted consideration and recommendations of creosoted processes and the overlooking of recent work and developments by such associations as the American Wood Preservers' Association and the National Electric Light Association, as represented by their reports and specifications.

Unfortunately, Mr. Sackett appears to have overlooked the work of the overhead systems committee, Technical National Section of the National Electric Light Association, as represented by its report released May 20, 1924, containing "Specifications for Creosoted Yellow Pine Poles, No. D 5-24 T," as he states that "So far only one attempt has been made to provide specifications for Southern yellow pine poles—the adoption by the National Electric Light Association, about 1914, of the A. T. & T. specifications."

The article states that an initial air pressure is an essential requirement. The A. W. P. A. "Standard Specifications for the Preservative Treatment of Poles by Pressure Process," adopted 1924, as well as the above-mentioned specification of the N. E. L. A., contains the following without any discrimination: "Empty Cell Process Without Initial Air." Should not your subscribers have all the facts?

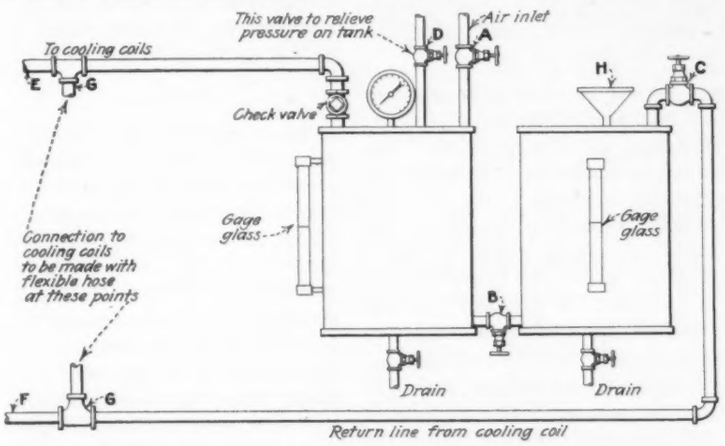
E. P. GOWING,
Assistant to Vice-President.
American Creosoting Company,
Louisville, Ky.

Central Station and Industrial Practice

Transformer Cooling Coil Scale Removal

BY A. M. CHAPEL
Production Department, Ohio Public Service Company, Mansfield, Ohio

TROUBLE has always been experienced at the Ohio Public Service Company's Melco plant from the formation of scale in the cooling coils of the transformers, and it has been necessary to remove this scale with a one to five solution of hydrochloric acid at regular intervals during the summer to prevent overheating of the transformers. This was formerly done by pouring the acid into pipes connected to the coils and extending above the transformers, but this method was too slow—a day being required to clean two large transformers.



APPARATUS FOR CLEANING COOLING COILS OF LARGE TRANSFORMERS

A motor-driven pump was then connected to them and the acid pumped through. This method gave very satisfactory results, but considerable time and labor were necessary in preparation. A permanent installation for doing this work has resulted in a considerable saving of time and money, as one man can easily operate the apparatus.

Referring to the sketch, there are two steel tanks, such as oil drums; one is airtight and the other is covered but not airtight. The pipes *E* and *F* extend the full length of the transformer room and each is provided with an outlet at each transformer, as shown at *G*.

Each tank is provided with a gage glass or other device to show the level of the acid. To operate, the cocks *B* and *D* are opened and the acid is poured through the funnel *H* until both tanks are half full. Cocks *B* and *D* are then closed and *C* and *A* are opened. The air pressure on the first forces the acid through the coils. As soon as the acid begins to come through pipe *F* into the second tank cocks *A* and *C* are closed, allowing the coils to remain full of acid for a few minutes (the check valve in pipe *E*, which extends to the bottom of tank, prevents the acid from returning to the first tank), after which cocks *C* and *A* are opened and all the acid in the coils is forced back into the second tank. This process is repeated until the acid is exhausted or the coils are clean. The apparatus and coils are then cleaned by circulating water through them. Hose connections are made between the outlets and transformers.

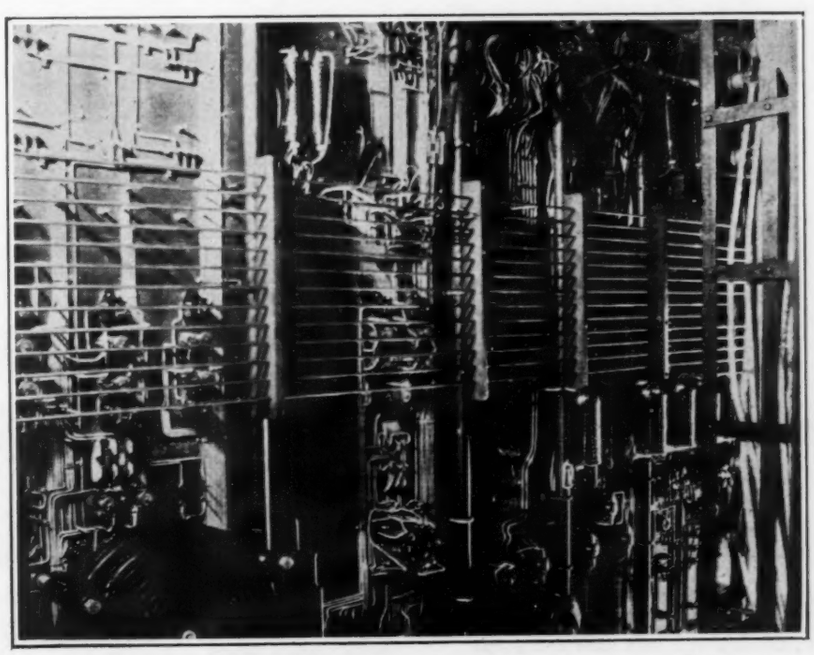
It is planned later to mount the apparatus on a small hand truck, so that it can be moved from one transformer to another. Then only short nipples will be needed to carry the acid to and from the tanks instead of long pipes.

Improving the Appearance of Switchboard Wiring

BY G. A. SEAMAN
Southern Colorado Power Company, Cañon City, Col.

IN MAKING the installation of a 6,000-kva., 30-cycle to 60-cycle frequency changer at the Cañon City plant of the Southern Colorado Power Company three new panels were added to the existing switchboard and the problem arose of deciding the kind of buses to install back of the board which would best suit the future requirements of the plant.

The control buses on the back of the original board were made of No. 8 rubber-covered copper wire supported by split porcelain knobs. This wiring was unsightly in itself and besides gave a poor appearance to



BRONZE BUS RODS REPLACE UNSIGHTLY WIRING ON BACK OF SWITCHBOARD

the back of the board. In addition to better appearing buses longer ones were needed, and it was decided to install ⅜-in. Tobin bronze bus rods cut so that they were equal in length to the entire switchboard. Holders for the bronze bus rods were made of ¾-in. red fiber cut into two pieces so that they fitted together on the line of centers of ¼-in. holes drilled in the fiber for the passage of the bus rods. These fiber strips were bolted to the 1¼-in. pipe rack to which the switchboard panels were fastened. As the potential on the buses did not exceed 125 volts, it was possible to space the bronze bus rods on 1½-in. centers. Where bus connections to the back board wiring were necessary the bus rods were drilled and the back board wires soldered in. The accompanying photograph shows the completed job. This installation resulted in a pleasing color contrast between polished bronze and red fiber holders and made a neat, workmanlike and substantial job on the back of the board.

Carbon Dioxide Fire Extinguisher System

BY P. W. EBERHARDT
General Safety Inspector Duquesne Light Company

THE introduction of the Lux system of fire protection, which employs the use of liquid carbon dioxide (CO_2) gas as the extinguishing medium, into the central-station field has effected a change in the methods of fighting electrical fires. It has made possible the use of automatic fire control which affords instant application regardless of whether or not the electrical potential has been removed.

In the Lux system the carbon dioxide is released and conveyed to outlets in liquid form, thus overcoming the objectionable possibility of freezing, as was previously experienced in applying CO_2 as an extinguishing medium. It also has additional decided advantages over other extinguishing media in that it is a non-conductor of electricity, is not poisonous, in no way injures materials or apparatus and does not create any objectionable residue that must necessarily be cleaned up. Another advantage with this system is the small amount of floor space required for the installation, the importance of which is a decided factor in modern central-station design.

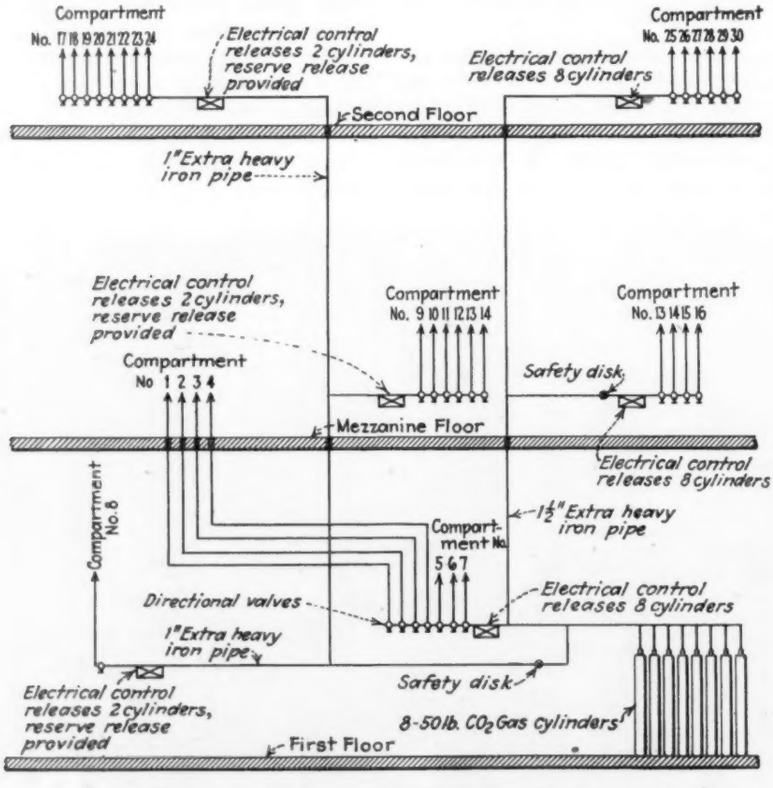

Compartment
No. 17 18 19 20 21 22 23 24
Electrical control releases 2 cylinders, reserve release provided
Electrical control releases 8 cylinders
Compartment
No. 25 26 27 28 29 30
Second Floor
1" Extra heavy iron pipe
Electrical control releases 2 cylinders, reserve release provided
Compartment
No. 9 10 11 12 13 14
Compartment
No. 13 14 15 16
Compartment
No 1 2 3 4
Safety disk
Mezzanine Floor
Electrical control releases 8 cylinders
Compartment No. 8
1½" Extra heavy iron pipe
Compartment No. 5 6 7
Directional valves
Electrical control releases 8 cylinders
1" Extra heavy iron pipe
Safety disk
Electrical control releases 2 cylinders, reserve release provided
8-50 lb. CO2 Gas Cylinders
First Floor

FIG. 1—PIPING SCHEME OF THE LUX (CO_2) SYSTEM

This system, designed to protect 32 compartments and vaults, is now being installed at Stanwix substation. This is one of three major substations that supply downtown Pittsburgh with both light and power.

On the Duquesne Light Company system Lux fire protection has been installed at Colfax power plant, East End, Wilkinsburg, Lawrence and Stanwix substations for transformer vault and oil-switch compartment protection, and at Woodville substation for automatic protection on a Westinghouse 7,500-kva. synchronous condenser. Consideration is also being given to automatic CO_2 gas fire protection for the isolated phase oil circuit breaker structure to be constructed at the Brunot Island power plant, as well as protection for the fourth generating unit at Colfax power plant.

INSTALLATION

The apparatus as installed on our properties consists chiefly of a bank of 50-lb. capacity standard Lux CO_2 cylinders (the number of cylinders being determined by the volumetric content in the largest room to be protected), connected to a common manifold or group of manifolds (Fig. 1). Extra-heavy iron pipe and steel fittings complete the connections between the manifold, through directional valves, to the compartments to be protected (Fig. 3).

In each room to be protected the piping system is carried around the entire circumference of the room, and is furnished with Monel metal orifices through which the gas is liberated when the system is put into operation. These orifices are usually located slightly above the apparatus proper, with one or two near the floor to take immediate care of any oil that may be burning at this point (Figs. 1 and 4).

OPERATION

To operate a remote control system, it is only necessary for the attendant to open the directional valve to the section in which a fire has occurred and to operate a small tumbler switch located near the directional valve, as shown in Fig. 2. In case of failure of electric supply a lever is provided, with which the release can be mechanically operated by means of a flexible cable installed in ½-in. conduit, which is connected to the trip mechanism.

The operation of the tumbler switch or flexible cable releases a trigger, which supports, on a common shaft, latches that engage weights, which in turn are connected to release valves on the CO_2 gas

cylinders. The weights, when released, travel about 120 deg. on an arm, driving a Monel metal cutter through a disk, thus releasing the contents (50 lb. liquid carbon dioxide under 850 lb. per square inch at 70 deg. F.) under its own pressure into the manifold and to the compartment to which the directional valve has been opened.

MAINTENANCE

Periodic renewal of the chemical is not necessary, as CO_2 gas does not deteriorate. However, a small leak in any one of the cylinders may cause a slow gas discharge, and to indicate this condition the entire bank is placed on platform scales to which an electric alarm is attached. A leakage of 2 lb. of gas, which represents about 0.8 per cent of the volume of the installation illustrated, will cause the alarm to sound, indicating to the attendant that the cylinder should be reweighed. However, recharging need not be undertaken until the loss of pressure exceeds 10 per cent of the total charge.

Should the gas be discharged, the cylinders can be readily recharged by any manufacturer of CO_2 gas at a very nominal cost (about $3 to $6 per cylinder, depending on locality). Nevertheless it is considered good operating practice to maintain a sufficient number of reserve cylinders.

On May 3, 1925, tests of the apparatus were conducted at our East End substation, where three oil circuit breaker bays and two transformer vaults are equipped with CO_2 fire protection. The room selected for test is known as oil switch room No. 4 and has an approximate volume of 2,200 cu.ft.

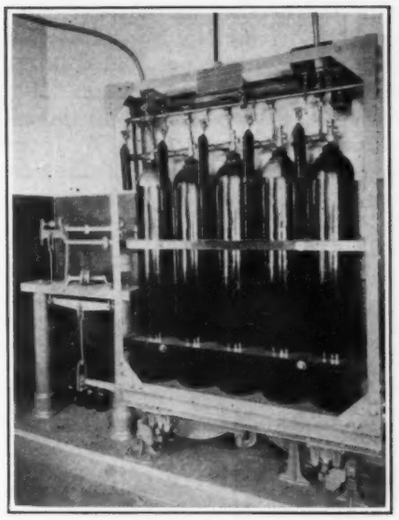


FIG. 2—BATTERY OF CO_2 GAS CYLINDERS MOUNTED ON TEST SCALES AT EAST END SUBSTATION

This group is capable of taking care of any compartment having a content up to 5,000 cu.ft.

During the tests conducted in this compartment, it was noted that:

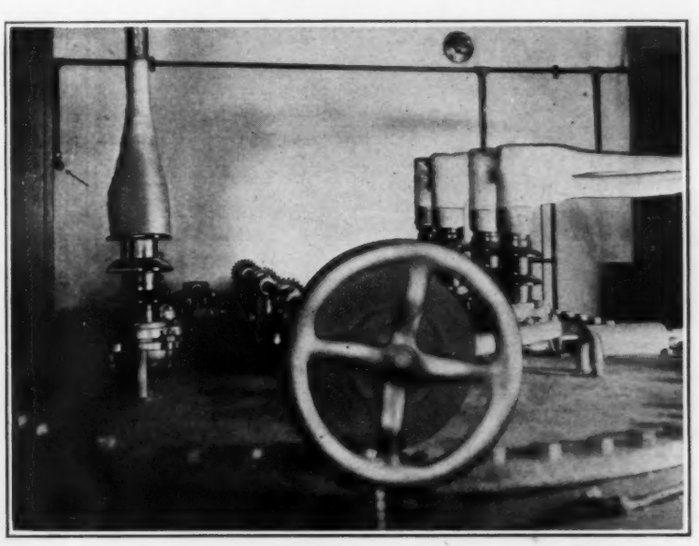
1. Lighted newspaper torches were immediately extinguished on entering the door of compartment under test.
2. No ill effect, either during or after the discharge of gas, was experienced by those walking through the compartment in which the test was conducted. However, it is recognized that with the presence of CO_2 gas the oxygen content of the remaining air in the room would be insufficient for normal respiration. Accordingly, hose-type fresh air masks are provided for the attendants as an additional safety measure.
3. The entire supply of gas was released in approximately 50 seconds and any fire that could result in the compartment under test would have been extinguished in about fifteen seconds. No freezing or stoppage of flow of gas was experienced.
4. No appreciable increases in pressure in the vaults were experienced.
5. Due to the very high rate of discharge, the amount of gas supplied was sufficient to take care of all normal openings around doors, windows and electrical conductor entrances, without affecting the efficiency of the system.
6. One 50-lb. cylinder is capable of extinguishing a fire in a compartment having a maximum volume of 1,000 cu.ft., with a liberal factor of safety.

In summing up, we believe that the Lux CO_2 gas fire-extinguishing system has a direct application to transformer vaults, switch compartments, regulator compartments, etc., and that the simplicity of the application affords rapid and positive fire protection, which tends to insure continuity of service and eliminate the many hazards that usually attend any fire around electrical equipment.

Supervisory Control for Isolated Breaker

BY H. C. JONES
Design Engineer Duquesne Light Company, Pittsburgh, Pa.

THIS control scheme was developed for a remotely located breaker on the Duquesne Light Company's system that opens quite frequently. The control point is located approximately four miles from the circuit breaker. Between these two points there is one No. 6 lead covered wire mounted on an existing pole line. No provision is made in this scheme for tripping from the control point, as it was deemed unnecessary due to the fact that the operator at the control point has no



APPLICATIONS OF LUX CO_2 GAS FIRE-EXTINGUISHING SYSTEM IN DUQUESNE LIGHT COMPANY SUBSTATIONS

Fig. 3 (left)—One of the remote control fire stations at East End substation which takes care of two oil circuit breaker sections and one transformer vault.

Fig. 4 (right)—A Westinghouse 10,000-kva., 22/4-kv., "Inertaire" transformer vault, showing method of piping and one of the monel metal orifices.

indication as to what the load condition is on this feeder; therefore the tripping is accomplished by the protective relays on the feeder.

The scheme of connections is shown in the accompanying diagram. The breaker is assumed in the open position. The closing of the control switch will then close the "MC" relay No. 1, which allows sufficient current to flow through the "O" relay to operate it, which has its contacts in parallel with a standard control switch for closing the breaker. When the breaker closes, the auxiliary switch changes position, thus de-energizing the "O" relay and allowing it to drop back to the off position. At the same time "MC" relay No. 2 will drop back to the off position, due to the additional resistance at *A*, thus showing the customary red light. With the breaker in the open position, the green light will burn due to the resistance *A* being disconnected and the coil of the "O" relay being substituted, which allows "MC" relay No. 2 to close. The white light is used to indicate an open circuit in the line. It burns as long as the line is complete but goes out when the circuit becomes open.

The resistances *A*, *B*, *C*, and *D* were worked out in such a way that with the breaker in the open position "MC" relay No. 2 will close but the "O" relay will not, and with the breaker in the closed position "MC" relay No. 2 will open due to the additional resistance at *A*. With the breaker in the open position the closing of "MC" relay No. 1 allows sufficient current to flow to operate the "O" relay.

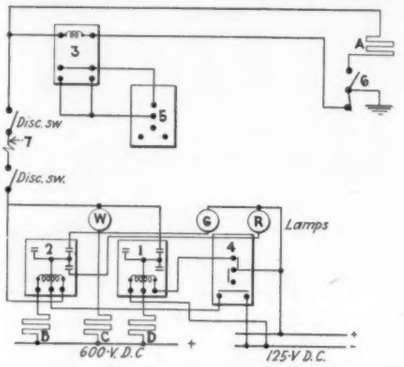


DIAGRAM OF SUPERVISORY CONTROL OF REMOTE BREAKER

A—Ward Leonard resis. 2,274 ohms 0.03 amp. capacity.
B—Ward Leonard resis. 9,500 ohms 0.03 amp. capacity.
C—Ward Leonard resis. 3,940 ohms 0.03 amp. capacity.
D—Ward Leonard resis. 638 ohms 1 amp. capacity.
1—W. E. & M. Co. "MC" relay resis. 2,500 ohms.
2—W. E. & M. Co. "MC" relay resis. 2,640 ohms.
3—W. E. & M. Co. "O" relay resis. 13 ohms.
4—W. E. & M. Co. control switch.
5—W. E. & M. Co. control switch.
6—W. E. & M. Co. auxiliary switch on breaker.
7—4 miles No. 6 wire approx. 8.5 ohms.

Should the breaker be opened by the protective relays, the control switch, by hand or accidentally, the operation will be indicated at the control point. Should the breaker be closed by any of the various means possible, this will also be indicated at the control point. This scheme has been in operation for about six months, and has proved very satisfactory.

Substation Design in Russia

THE accompanying illustrations are exterior views of two typical distribution substations in use on underground systems in Soviet Russia. Fig. 1 is a substation in Penza, a town in central Russia, and was designed to conform to the normal type of architecture found in the city. The primary voltage is 6,600 volts and the secondary is 220/110. Steel rings and white porcelain insulators are used quite widely in Russia in the way shown in the illustration.

A transformer kiosk in Arivan, Caucasia, the capital of Armenia, is shown in Fig. 2. The primaries come in from an underground system, but the secondaries go out overhead.

FIG. 1—TYPICAL TRANSFORMER KIOSK IN CENTRAL RUSSIA

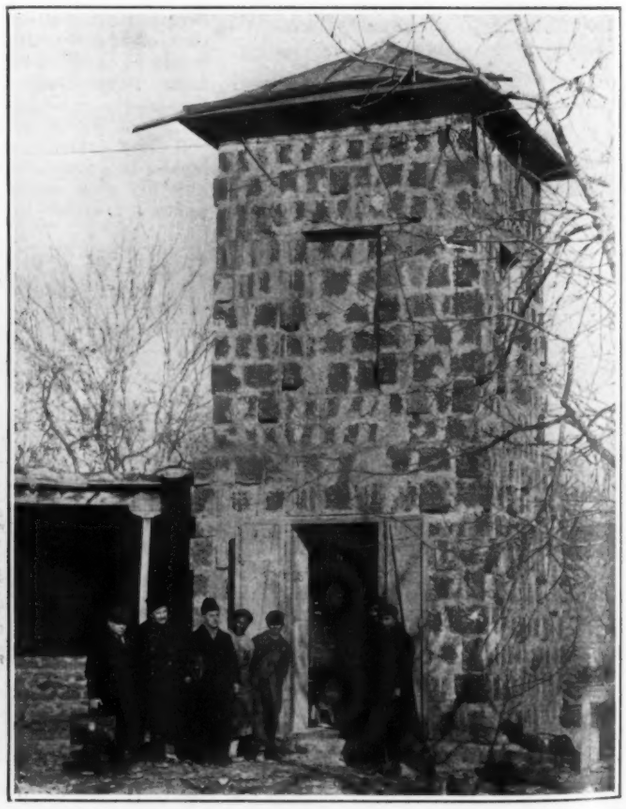


FIG. 2—TRANSFORMER KIOSK LOCATED IN THE CAPITAL OF ARMENIA

Commercial Activities and Public Relations

Toronto Builders to Put In Only Red Seal Wiring

AN ADVERTISEMENT appearing in the Toronto *Evening Telegram* of April 19 told the story of the progress made in installing "Red Seal" wiring in the Canadian city. Within a month the thousandth Red Seal house will have been inspected and the wiring approved and certified. The Electric Service League also announces a list of 112 Toronto builders who have agreed to install "Red Seal" wiring in all houses they build during 1926. More than 250 Toronto builders have put in one or more Red Seal wiring installations since the plan was instituted on Oct. 1, 1923. The agreement of more than a hundred construction men to install nothing but Red Seal wiring indicates the growth of the system in the esteem of both the builders and the general public.

Relation of Size of Family to Use of Electric Range

THE accompanying table gives the results of a study of seven typical range installations recently made by the St. Joseph Railway, Light, Heat & Power Company. The installations were picked from different sections of the city and illustrate the different ways in which ranges are used. Installations 1, 2 and 5 are in fairly large families which do all the cooking on the ranges, and investigation showed that they had all made a close study of methods of using the range with a minimum of inconvenience and kilowatt-hour consumption. Installations 3, 4 and 7 were larger ranges than the others but were installed in homes which did considerable entertaining, though the families were small. The effect of this is shown in the higher demand and greater consumption.

The central station has a large range load in St. Joseph and employs a demonstrator to further the economical and efficient use of electric ranges. It is of course impossible to tell customers directly when they should use their ranges, but by means of home demonstrations and cooking classes the owners are shown the best methods of using their equipment so that the food will be thoroughly cooked with a minimum of attention and a well-distributed and small energy demand.

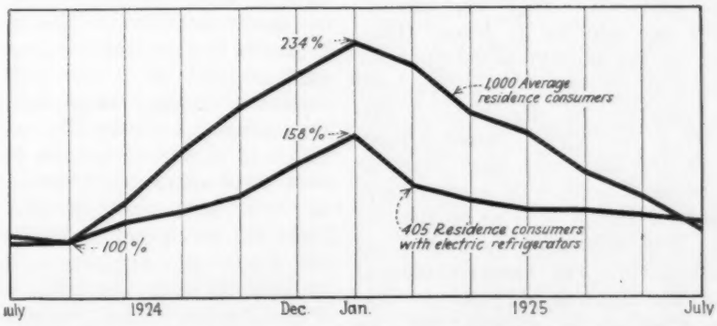
DEMAND AND CONSUMPTION OF SEVEN RANGES IN ST. JOSEPH, MO.

No. in Family	Size Range, Kw.	Demand, Kw. 15 Minute	30 Minute	60 Minute	Average Consump. Kw.-Hr. per Month	30-Min. Dem. L. F., Per Cent	Capacity L. F., Per Cent	Installation No.
5	6	3.2	3.0	2.9	176	8.15	4.1	1
5	5.4	2.6	2.1	1.4	133	8.8	3.5	2
2	7.5	4.0	3.1	1.8	142	6.4	2.6	3
2	7.5	5.0	4.5	3.7	217	6.8	4.0	4
6	5.4	2.4	1.5	1.0	167	15.5	4.3	5
2	4.2	2.5	2.3	1.9	86	5.2	2.9	6
2	7.0	4.7	4.3	3.2	210	6.8	4.2	7

Domestic Refrigerator and Load Factor

Power Companies' Need for High Load Factor Business—Effect of Electric Refrigeration on Residential Customers' Energy Consumption and Revenue

THE effect of the domestic electric refrigerator in improving the load factor of the residential customer was graphically illustrated by G. E. Miller, sales manager of the Cleveland Electric Illuminating Company, at a recent regional meeting of the A.I.E.E. held in Cleveland. Load factor improvement, Mr. Miller pointed out, is one of the master problems confronting central-station companies today. Every power company has before it the serious problem of reducing costs, both capital and operating. In 1910, Mr. Miller stated, the electric utility's total investment per kilowatt of system capacity was in the neighborhood of $360. Shortly before and during the war period this was reduced to about $255, but since that time it has been steadily creeping up until it is now between $280 and $300 per kilowatt, and with distribution investment continually increasing it appears probable that the total investment will again reach a figure of $350 or more per kilowatt. As these costs have gone up the tendency has been to reduce the selling price of electric energy so that it now becomes necessary to make the central station's investment work harder. This can be accomplished only by improvement in load factor, but companies are confronted by the fact that over the last ten years there has been no appreciable improvement. On some systems slight improvements of 2 or 3 per cent have been made, but on others an equal decrease has been shown, so that on the whole the average load factor throughout the country remains about the same.



COMPARISON OF SEASONAL VARIATION IN ENERGY CONSUMPTION OF AVERAGE RESIDENTIAL CUSTOMERS WITH THOSE USING ELECTRIC REFRIGERATORS

Curves are plotted to logarithmic scale in order better to show the percentage of variation between minimum and maximum requirements.

The load factor of the residential customer is notoriously low, be-

tween 10 and 12 per cent, Mr. Miller pointed out, and the use of electricity in the home brings to the central-station company a gross annual revenue of only a little more than $25. At the same time it costs the power company a minimum of $25 to $30 to connect a house for service when all distribution facilities are in and the total investment in generating, transmission and distribution facilities may run as much as $200 or $300 per customer.

REFRIGERATORS DOUBLE REVENUE

Installation of a domestic electric refrigerator in the home of a residential customer at once effects an increase in the customer's energy consumption of at least 500 kw.-hr. per year, which at a 5-cent rate doubles the revenue received. At the same time no increased investment in the power company's distribution system is required, as the refrigerator is a so-called socket device and the sale of each machine is equivalent to adding one new customer.

The characteristics of the domestic refrigerator load make it one of the most attractive that an electric utility can add to its lines. Load factor of the individual refrigerator is between 25 and 30 per cent and the diversity of use among customers is very good. After a number of the machines have been installed on a company's system their daily load factor is close to 100 per cent. The season of maximum use comes during the summer months when the lighting demand is low, thus tending to smooth out the average monthly energy consumption. This effect is illustrated in the chart on page 1061, which compares the seasonal variation in the energy consumption of 1,000 average residential customers with that of 405 customers with electric refrigerators. Minimum monthly consumption is considered as 100 per cent and the curves are plotted to show the percentage of variation; it will be seen that the average customers have a maximum variation of 234 per cent, whereas those using refrigerators have a maximum variation of only 158 per cent. The desirability of this type of load is obvious.

SALES POSSIBILITIES

On a national basis the electric refrigerator presents most attractive possibilities for increasing the electric utilities' gross revenue, in Mr. Miller's opinion. There are 14,500,000 homes now connected to the central-station lines in the country and new residential customers are being added at the rate of about a million a year. It ought to be entirely possible in three years, he declared, to sell refrigerators to 10 per cent of these customers, or by 1929 to place 1,400,000 refrigerating machines on the lines of the power companies.

Each of the machines consumes on an average of 500 kw.-hr. per year, which at a rate of 5 cents per kilowatt earns an annual revenue of $25. At this rate and on this basis 1,400,000 refrigerators by 1929 will add $35,000,000 annually to the central-station companies' gross revenue. With further price reductions it should be possible to sell 25 per cent of the residential customers, which would bring a gross annual revenue of $87,500,000 at a 5-cent rate. This is believed to be well within reasonable possibilities.

Spring Cleaning

A LETTER-SIZE mailing piece with this sketch printed in two colors at the top is being sent out to 6,500 merchants and factory executives in Cincinnati by the Union Gas & Electric Company. This, with accompanying newspaper advertising, is tied in with the annual spring cleaning campaign, the familiar slogan of which has been enlarged to read "Clean Up, Paint Up, Light Up."

Electric Floor Waxers Help February Sales

STARTING on Feb. 1, the Empire District Electric Company, Joplin, Mo., sold 25 electric floor waxers for domestic use in less than one month. This is the first time this appliance had been sold by this company and it proved successful even during a month which is generally considered inactive from a merchandising point of view.

The floor waxer was sold for $45 on the payment plan, with a wax mop and a pint of floor polish given with it. The company's new-business department believes that it will become popular in the same way that the vacuum cleaner became a widely used household appliance. Window displays, canvassing and a small amount of newspaper space were the methods by which interest was aroused and this number of appliances sold on the first attempt.

Wisconsin Utilities Grapple with Radio Interference

THE causes of radio reception interference have been listed in three distinct classes. The total list includes 53 causes, of which only nine can be attributed to defective central-station lines. In spite of the small proportion of its possible offenses in the total of all causes, the central station has, as a matter of public policy, tacitly accepted a large part of the blame and has vigorously undertaken the job of keeping the radio listener happy so far as conditions in its control are concerned. Many companies are employing competent radio men to operate newly established radio service departments. These departments are being equipped with the most sensitive equipment available with which noises that may be caused by company equipment can be located.

The realization of these facts and the desire to co-ordinate the efforts of member companies in eliminating—or, at least, materially reducing—radio interference were the animating reasons for a meeting of the radio committee of the Wisconsin Utilities Association on March 11. A state-wide plan for company co-operation was formulated.

The official list of the causes of radio interference are:

In Receiver or Apparatus Connected to It.—Improperly tuned receiver; loose connection in receiver or broken wires in head phone or loud-speaker cord; defective grid leak; defective tuning condensers — momentary shorting of condenser plates; fixed condenser with defective insulation; discharged or weak batteries; loose connections at batteries; B battery eliminators; electrolytic type under certain conditions; bad socket; bad tube.

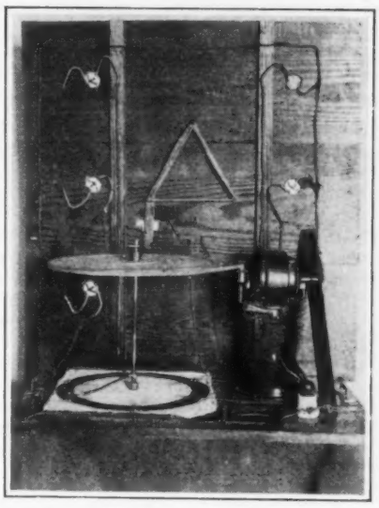
From Apparatus in Same House with Receiver or in Neighbor's House.—Vacuum cleaners; sewing machine motors—any commutator motor; violet-ray machines; ozonators; doorbells and buzzers; switching off lamps or other electrical devices; electrical heating pads with thermostatic control; oil burners using spark ignition—certain types; washing machines with split-phase type of motor—starting switch defective; battery chargers, vibrating

type; battery charges; electrolytic type, under certain conditions; elevator controllers and motors of the commutator type; bad contact switch, fuse, socket or other device; hum caused by having radio receiver or its wiring near lighting wires.

From Outside Sources.—Atmospheric static; regenerative receivers; sign flashers; commercial wireless (code) station; amateur wireless stations; induction coils; electric street cars; defective rail bonds on street railway systems; heterodyning of broadcasting stations; overlapping of broadcasting stations; telephone ringers; induction from telephone and telegraph lines; motion picture machines using arc lamps; motors and generators of the commutator type, electric welding apparatus; X-ray machines; static machines; static produced by belts; electrical manufacturing processes; induction from high potential circuits; arcing wire in trees and other ground objects; leaking insulators on power circuits; defective lightning arresters — power circuits; loose street lamp in socket; bad contact in switches; lightning arresters; smoke or dust precipitators; defective transformer; defective street light rectifiers.

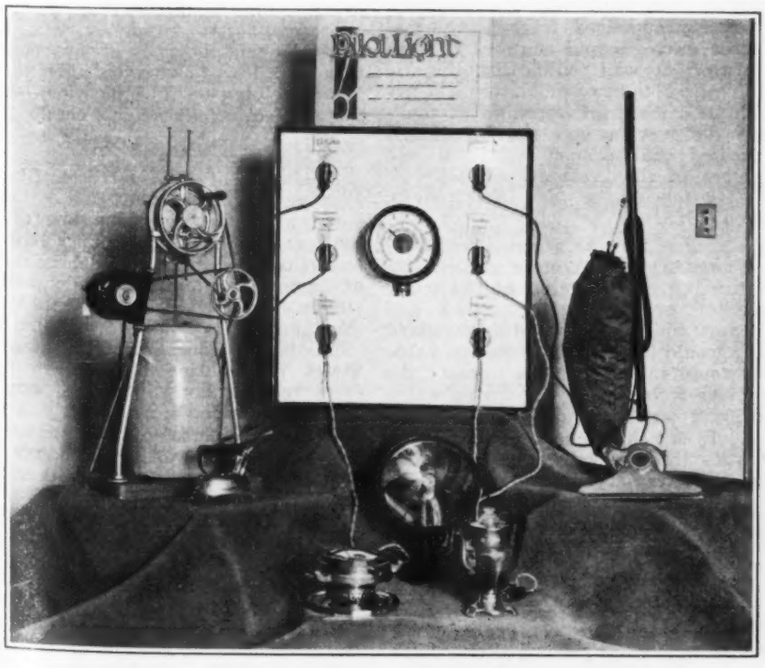
Cost of Using Appliances Shown by Board

AN AUTOMATICALLY operated board to show successively the cost per hour of six different appliances is shown in the accompanying illustrations. This board was built by H. J. Wilkinson of the Gadsden office of the Alabama Power Company. It is an ideal apparatus for window display, electrical shows, etc., as the board tells its own story and requires very little attention. As shown in one of the illustrations, the driving mechanism is quite simple. On this particular board an electric fan motor furnishes the power. The oscillating attachment is used to drive, by means of a heavy elastic band, a 15-in. grooved wheel to which is attached the contactor apparatus. There are six contacts of thin sheet copper fastened to an asbestos mat, these forming a circle the outside diameter of which is 13 in. The contact arm attached to the large wheel makes one revolution in 50 seconds, which means that each appliance is in the circuit about six seconds.



REAR OF APPLIANCE BOARD SHOWING DRIVING MECHANISM

The board itself is made from pressboard and is 35 in. high and 32 in. wide. Two-way detachable sockets are arranged as shown. A pilot light is inserted in one end, and the plug of the appliance is placed in the other end. In the center of the board is an indicating wattmeter calibrated in cents per hour, based on the rates used at present by the Alabama Power Company.



AUTOMATIC BOARD USED TO SHOW THE COST OF USING VARIOUS APPLIANCES (VACUUM CLEANER OPERATING)

Energy Sales as a Barometer of Business Conditions

THE use of the kilowatt-hour consumption of electrical energy as a new barometer of business conditions was proposed by Arthur Williams, vice-president, in charge of commercial relations, of the New York Edison Company, in an address broadcast from Station W R N Y on April 27. Economists, business executives, investors and others deeply concerned with the future trend of business, Mr. Williams said, have become impressed with the inability of any combination of the old barometers to interpret accurately the immediate trend of business, let alone forecast the future trend. Pointing out that the electrical energy consumed in industry is directly in proportion to the amount of work being done, that 75 per cent of all the power used in industry is now supplied by the light and power companies and that even in the home the consumption of electricity reflects variations in the prosperity of the home owner, Mr. Williams predicted that the kilowatt-hour would be accepted as one of the most reliable barometers of commercial and industrial activity. This is particularly true since electricity, unlike other commodities, must be made as it is needed and must be used as it is made.

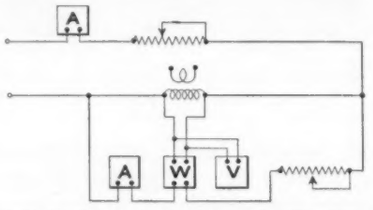
This method of determining business conditions was applied to New York by citing the increase in energy sales of the Edison-United Companies in 1925 over 1924 and the increase for the first quarter of 1926 over the corresponding period in 1925. The new building going on in the metropolitan section, the most tangible evidence of prosperity, was indicated by the new load connected to the lines. In the first quarter of 1926 the electric service contracted for new buildings exceeded the equivalent of 744,000 50-watt lamps as compared with 633,000 during the preceding three months, an increase of 16 per cent.

Digest of Electrical Literature

Generation, Control, Switching and Protection

Design of Oil Circuit Breakers.—P. CHARPENTIER.—In this very long paper the author develops modern theories for the design of oil switches which will be suitable for a given voltage and rupturing capacity. In the theoretical part of the article mathematical methods are given to calculate the variables which enter the switch design, such as electromechanical forces, volume of gases developed, speed of contacts, etc. The second part shows how to select a switch of sufficient capacity when it is intended to be installed at certain points of power systems, the characteristics of which are given by data and diagrams. Three such practical examples are given, with complete data. The author is led to believe that his assumption of an arc length of 1 cm. per kilovolt may be somewhat too long, particularly when compared with recent American tests. He admits that very meager data of a reliable character are so far available on the exact nature of the gas evolution during the opening period of oil switches, and he suggests investigating this important problem by high-speed motion pictures of switches with plate-glass panels cemented over openings in their steel tanks. Many other points, such as the ionizing effect of the gases, speed of opening, gas pressure, height of oil above the break, etc., are yet to be fully investigated.—*Revue Générale de l'Electricité*, Feb. 20, March 27 and April 3, 1926.

Maximum Volt-Ampere Output of Series Transformers.—G. W. STUBBINGS — The maximum volt-ampere output as usually given is that which can be supplied at rated primary current without certain limits of ratio and phase error being exceeded. The output depends upon the impedance of the connected instruments or apparatus such as relays. It falls to zero if the impedance is either zero or infinite (open-circuit). The study under notice is directed rather to the use with relays, where ratio or phase error is of smaller importance. The theoretical investigation makes use of the assumption of a parabolic saturation curve and leads to a maximum volt-ampere output $M = \frac{0.955\,(IN)^{3/2}\,f}{K_1}$, where IN is the number of secondary ampere turns, K_1 a constant depending on the dimensions of the core, and f the frequency, while the relation between the corresponding power component of current i and total current I is expressed by $i^2 = {}^2/_3 I^2$. Results of actual tests show that the output rises almost linearly with secondary impedance, comes to a peak and falls off rapidly as the impedance continues to be increased. Thus in one transformer doubling the critical value of secondary impedance gives about three-quarters of the maximum output and six-tenths of the maximum current. Relay settings will therefore have to be reduced if they are to function at a desired current in the primary. A diagram of connections for an approximate test for maximum output is shown herewith. The method is indirect and assumes non-inductive secondary load. The wattmeter series coil, ammeter and adjustable rheostat are shunted across the secondary winding, the primary being on open circuit. The potential coils and the voltmeter are connected across the secondary terminals. The current in the main circuit is kept constant at a value



CONNECTIONS FOR AN APPROXIMATE TEST OF MAXIMUM OUTPUT OF SERIES TRANSFORMERS

equal to rated primary current divided by the turns ratio. By adjusting the shunting rheostat the maximum volt-amperes can be read off on the wattmeter.—*World Power*, March, 1926.

Transmission, Substations and Distribution

Colored Insulators.—C. A. BURNIER.—Porcelain insulators are sometimes made in certain colors either to blend with the surrounding scenery or to make them less inviting targets. Investigation of the characteristics of such insulators showed that electrically they are not noticeably different from white porcelain, but that they are subjected to more pronounced internal thermal stresses during rapid changes of temperature. It was found that the use of blue or blue-gray insulators did not result in a material lessening of malicious destruction and the opinion is expressed that proper education will do more in that respect.—*Bulletin de l'Association Suisse des Electriciens*, March, 1926.

Judging the Value of an Arrester.—O. WESTERMANN.—A more general understanding of the value of the many types of overvoltage protectors and arresters which are offered as standard today would be of great economic value and would in many cases prevent the customer from buying apparatus which could not possibly fulfill the intended task. In six short chapters the author analyzes the various types and active parts of a variety of protective apparatus and explains their usefulness. Of paramount importance is the proper dimensioning of the useful internal ohmic resistance. If it is found to be too high for a successful deliverance of traveling waves, the apparatus may still be useful to protect against overvoltages of a more prolonged character. If an arrester will respond to sudden overvoltages, it will do so only if its gap has a minimum of time delay of discharge. The design of the gap will, therefore, have a very material influence upon the performance of a protector. On the other hand, the shape of the gap is immaterial if protection against overvoltages of comparatively long duration is sought. The heat capacity of damping resistances will be a direct measure of the ability of the arrester to withstand prolonged discharge. A record of the frequency of functioning should not be taken as an indication of an arrester's usefulness, because it would not be known whether every functioning resulted in an actual protection. Resistances have been known to change their ohmic value after functioning and should therefore be checked at frequent intervals to assure their proper performance.—*Elektrotechnische Zeitschrift*, Feb. 25, 1926.

Units, Measurements and Instruments

High-Voltage Indicator.—O. LOHAUS.—A small, readily portable indicator is described which shows whether an alternating-current line is dead or alive. The instrument contains a double-grid vacuum tube, to which is connected an oscillating circuit comprising a coupling transformer, a capacity and a small battery. An antenna wire, about 6 in. long, protrudes from the cover of the case, while a set of ear phones serves as detector. A loud steady tone is heard in the earphones when the instrument is far from live lines or next to dead conductors. If the instrument is approached to energized wires, a more or less rhythmic noise will be heard, or the tone will disappear altogether. So sensitive is the instrument that an approach to within 18 in. of a wire carrying 220 volts will give a distinct intermittent signal. Bringing the indicator to within 60 ft. of a live 110-kv. line will also give an unmistakable danger signal. Since the instrument operates, so to speak, on the null-method principle, it is always possible to assure its proper working condition before relying on its indication.—*Elektrotechnische Zeitschrift*, Feb. 25, 1926.

Illumination

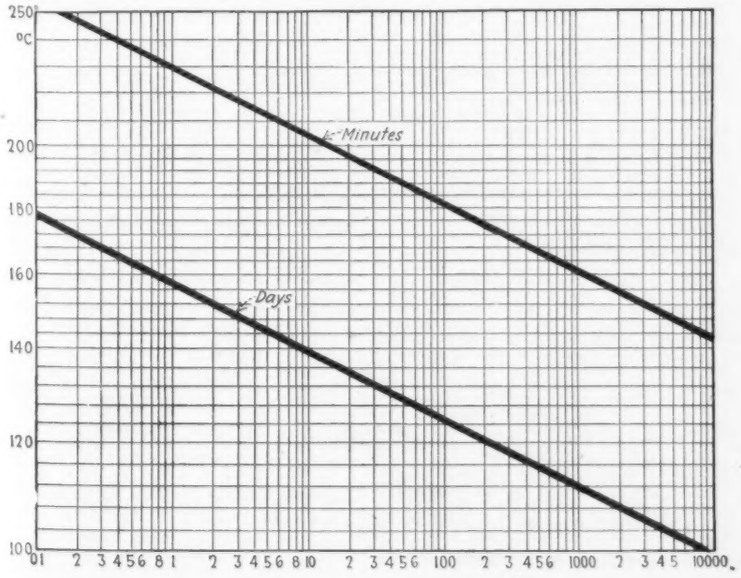
Prediction of Daylight from Sloping Windows.—H. H. HIGBIE and A. LEVIN.—On an earlier occasion one of the authors published a paper dealing analytically with the predetermination of daylight illumination under certain simple conditions. In the present paper that analysis is amplified, rational formulas being deduced for predicting the direct illumination at a given point from rectangular windows of any dimensions having a uniformly bright outlook. Because of the numerous dimensions involved in defining the position of the point with reference to the window the equations are necessarily quite long, too long to be here reproduced, but their numerical solution in a specific case is not particularly tedious. To facilitate the use of the method a scheme of tabular computation is given, accompanied by illustrative charts plotted in terms of ratios between window height and length, and between distance from the

window and its height, for a particular angle of slope. The rational formulas are checked against elementary theory, against formulas previously published by other investigators and against laboratory tests with artificial windows, as well as against field tests of natural illumination in real buildings. It is shown that they are in close agreement with measured results.—*Transactions of I.E.S.*, March, 1926.

Practical Daylight Calculations for Vertical Windows.—WENDELL S. BROWN.—Curves are given in this paper to facilitate the predetermination of daylight under assumed conditions of sky brightness, and their application is discussed. No attempt is made to prove their derivation, reference being made instead to an earlier paper by the same author.—*Transactions of I.E.S.*, March, 1926.

Motors and Control

Starting Switch for Motors.—G. GUT.—Owing to the very detrimental effect which prolonged overload has upon the life of an electric motor, great attention has been given in late years to their adequate protection. The author gives an interesting curve (see illustration) which indicates the life of three-phase motors in minutes and days in relation to the temperature of the insulated windings. This curve shows, for example, that the average motor will last only about one minute with its copper 230 deg. C. hot. The paper describes, after this general introduction, a recent design of motor-starting boxes wherein the starter switch is mechanically latched in and where the latching toggle stands under the mechanical influence of a calibrated bimetallic strip. Short overloads, such as are occasioned by the rush of the starting current, are disregarded; but if sustained, the bimetallic strip, which is made part of the power circuit, will bend and will unlatch and open the switch. The thermal strips are available in sizes from 1 amp. to 64 amp., and by changing the distance between the tip of the strip and the toggle a fine adjustment of about 20 per cent can be obtained.—*Brown, Boveri Mitteilungen*, April, 1926.



LIFE OF MOTORS IN RELATION TO TEMPERATURE OF WINDINGS

Electric Drive of Elevators.—A. CURCHOD.—The paper gives a short history of the development of motor-driven passenger elevators. Discussing the desirable characteristics of motors suitable for this type of service, the author shows which direct-current and alternating-current motors can best be used. Detailed descriptions, illustrated by wiring diagrams, are given of various methods of motor control. As the article is written primarily for European consumption, only drum-type winches suitable for low buildings are mentioned. More than one page of the paper and three of the twelve illustrations are devoted to the Otis-Pifre micro-drive. Considerable stress is laid on various electrical and mechanical safety devices for elevators to guard against the drop of the cabin and the overrunning of the end position.—*Revue Générale de l'Electricité*, March 20, 1926.

Heat Applications and Material Handling

Welding Ice-Cream Cans Electrically.—ROGERS A. FISKE.—Automatic arc and resistance welders used in the process of manufacturing ice-cream cans have made it possible to close the longitudinal and bottom seams of a can in one-fourth of the time formerly required. The can metal is No. 18 gage black sheet. The cylinder material is cut to size, rolled to shape and delivered to the automatic arc-welding machines. Each of the two machines in the factory described, which receive energy from a 400-amp. constant-potential generator, uses from 70 amp. to 75 amp. at 20 volts. The welding is done with $\frac{3}{32}$-in. "Armco" wire. The longitudinal seam of a can is 18 in. long and is welded in 30 seconds; that is, at the rate of 180 ft. per hour. The edge is then ground smooth, the flanged bottom being pressed in place and welded by resistance heating between two thick circular copper electrodes, which are slowly rotated so as to roll the flange between them, one electrode being inside and the other outside of the can, while water is continuously played on them to keep them cool. Speeds of 45, 66 and 87 r.p.m. are available, so that the 30-in. circumference of the can is welded in a fraction of a minute.—*Iron Age*, April 15, 1926.

Effect of Hardening and Tempering Steels on the Thermo-Electric Electromotive Force.—P. NICOLAU.—This article describes a study to determine the effect of certain heat processes on the thermal emf. of selected steels. The results are given in chart form.—*Abstracted from Revue de Métallurgie*, August, 1925, in *Iron Age*, Feb. 11, 1926.

Traction

Automatic Control of Cable Cars (Funicular Railway).—F. BALESTRA.—Utmost simplicity of operation together with economic and reliable performance is the chief feature of a Swiss mountain railway leading under a grade of 53 to 73 per cent to a mountain top 600 ft. above the valley. Two cars operate on the road, the descending car being connected to the ascending car over a $\frac{3}{4}$-in. steel cable. A 15-kw., three-phase motor, installed in the upper-end station, drives two large wheels over which is slung the connecting steel cable. The operator on the car merely closes a switch, which starts a controller driven by a small auxiliary motor at the top station. A triple pantograph on each car maintains contact with three overhead control wires, through which the entire operation and various safety devices of the road are maintained. The complex wiring diagram is reproduced in the article. The cars each carry up to either 20 passengers or 15 tons of freight and travel at a speed of 1.6 feet per second. One haul of the completely loaded car up the mountain consumes only 0.6 kw.-hr. at 350 volts, three-phase, 50 cycles. The road has been in successful operation for two years.—*Brown, Boveri Mitteilungen*, March, 1926.

Telegraphy, Telephony, Radio and Signals

Methods of High-Quality Recording and Reproducing of Music and Speech Based on Telephone Research.—J. P. MAXFIELD and H. C. HARRISON.—An abstract of this A.I.E.E. midwinter convention paper may be found in the ELECTRICAL WORLD for Feb. 20, on page 397. The methods in question include on the recording side an electrical amplification between the receiver and the recording mechanism, so that the energy of the sound waves is used only to control, but not to actuate directly, the cutting stylus. On the reproducing side the record similarly serves to control the electrical amplifier from which the sound-generating device gets its energy. The paper outlines the requirements and limitations of the various elements, describes their construction and functioning and gives a detailed analogy between the electrical and mechanical systems. With the aid of this analogy it is possible to apply the theory of electrical transmission directly to the other system.—*Journal of A.I.E.E.*, March, 1926.

Scientific & Industrial Research

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Frequency Meter, Campbell's

This instrument was designed for the accurate measurement of acoustic frequencies from about 180 to 4,000 cycles. It is of value in telephone work. The instrument depends for its operation upon the action of two mutual inductances, the secondaries of which form a closed circuit having a definite resistance for one range. The resistances in this circuit are suitably connected to studs, over which a switch can be moved to change the range. The condition of balance is indicated by silence in the telephone. The accuracy of adjustment is such that at 1,000 cycles readings may be taken to within 0.1 per cent.—*Cambridge Instrument Co., Ossining-on-Hudson, N. Y.*

Galvanometer, All-Copper, D'Arsonval

When using high-sensitivity galvanometers in low-resistance circuits, annoyance and error are caused by small resultant thermal electromotive forces within the usual galvanometer circuit. In tracing the circuit through the galvanometer, various metals are encountered, such as brass, copper, phosphor-bronze and silver, all in series between the terminals. Unless all parts of the galvanometer are at the same temperature, a resultant thermal emf. will be set up. The writer has constructed a galvanometer wherein all parts composing the electric circuit are made of copper. This procedure results in making the galvanometer nearly free from thermal emf., as shown by actual tests.—*W. R. Coley, Leeds & Northrup Company, Philadelphia.*

Lamps, Frosted-Inside

A practical method of frosting the inside surface of incandescent-lamp bulbs has been developed, and the fragility hazard which formerly existed has been overcome by a chemical treatment. The outside of this new bulb, being smooth, does not collect dust so readily and is more easily cleaned. The initial absorption of light due to the inside frosting is less than 2 per cent, whereas the outside frost absorbs 6 to 8 per cent. Moreover, the candlepower maintenance of the inside frosted lamp during its life is very much better than that of the lamp frosted on the external surface, and approximates that of the clear lamp.—*Edison Lamp Works, Harrison, N. J.*

Steel, High-Speed Tool, Nickel in

An attempt is usually made to avoid nickel in high-speed tool steels. It is increasingly difficult to secure melting stock free from nickel because of the use of scrap in blast furnaces and in steel-making processes. By reducing the carbon content from 0.7 to 0.5 per cent the steel which contained 3.5 per cent of nickel could be machined and showed normal performance in roughing cuts. These experiments indicate that small amounts of nickel in a high-speed tool steel the carbon content of which is properly regulated should exert no deleterious effect.—*Bureau of Standards, Washington.*

Power Stations, Overload Protection, Automatic

Two partly automatic booster converters, each of 3,700 kw. capacity, have been installed. With an ultimate capacity of five machines, the heavy load demand is provided for by water-cooled load-limiting resistors which cut in automatically on overload and cut out when the overload disappears. Load regulation is accomplished by the operator, and reverse-current protection is afforded by high-speed, heavy-current air circuit-breakers.—*Cleveland (Ohio) Electric Illuminating Company.*

Rubber, Vulcanized, Prevention of Deterioration of

Deterioration of vulcanized rubber by oxidation can be delayed by the use of substances which are themselves easily oxidized and which act as anticatalysts of oxidation. Recently two of the largest rubber companies simultaneously patented almost identical antioxidants. A sample of such material was employed in rubber compounds which were then subjected to an accelerated aging test. The results substantiate the claim that the durability of rubber with respect to the effects of light and heat can be increased about 600 per cent.—*Bureau of Standards, Washington.*

Radio Tubes, Reactivation of

Radio tubes eventually lose their sensitivity. The General Electric Company has found out that thoriated tungsten filaments can be rejuvenated. The reactivation process is quite successful and frequently makes a wonderful difference in the results obtained with a receiving set. The process is essentially the operation of the filament for a very brief interval at a specified high voltage (called "flashing"), followed by a lower voltage for a longer time (called "aging"), all of this with no grid or plate voltage. The flashing reduces some of the thorium oxide in the wire to thorium, and the aging forms the required surface layer.—*Bureau of Standards, Washington.* [This process should not be attempted without knowing the exact voltage and the duration of its application.—EDITOR.]

Watt-Hour Meters, Reduction of Temperature Error in

The compensator comprises a small piece of temperature-sensitive alloy mounted in the magnet shoe. Changes in temperature of the meter result in changes in the permeability of this alloy, which, therefore, shunts more or less flux from the active gap of the magnet. Since the temperature characteristics of the ordinary induction meter are not the same on loads of different power factor, this compensation will be exactly accurate for a given power factor only.—*General Electric Company, Schenectady, N. Y.*

Voltage Transformer, Shielded Resistor for

The 500,000-ohm working resistor connected across the high voltage is subdivided into sections of 20,000 ohms, each of which is inclosed in a metal shield which in turn is connected to a tap at the proper point of an auxiliary guard circuit. The charging currents from these shields to ground, therefore, flow in the guard circuit only and do not directly affect the working circuit. The error arising from capacitance to ground, though greatly reduced by the use of the guard circuit, is not completely eliminated and increases in importance very rapidly as the working voltage of the resistor is increased. For details see *Scientific Paper* No. 516.—*Francis B. Silsbee, Bureau of Standards, Washington.*

In Progress or Purposed

Brushes for Commutators and Slip Rings

A questionnaire was sent out to collect data on the characteristics of and operating experiences with the various types of brushes available for use on motor-generators and synchronous converters. Because of the wide diversity in the information supplied, it is considered necessary further to sudy this subject and to secure actual test information on a selected group of machines. An outline of test procedure is being prepared and a number of operating companies have signified their willingness to conduct such tests.—*F. W. Wyatt, Union Gas & Electric Company, Cincinnati.*

Calorimetry and Its Practical Uses

A matter of prime importance is the computation of dominant wave length and purity from data on spectral distribution. Extensive and elaborate tests of the agreement of experimental values with values computed from the spectral distribution on the basis of the best data available for the three "sensation curves" or "excitation curves" have been carried out at the Bureau of Standards. While the tests indicate a degree of agreement which is highly gratifying, they also indicate the desirability of a careful redetermination of the "sensation curves." It is understood that such redeterminations are either in course or immediately contemplated by several investigators. [Results of these tests are being used for various practical purposes, such as the standardization of railway and traffic signals.—EDITOR.]

Heaviside Layer, Height of

Preliminary experiments have been carried out with a view to the determination of the height of the Heaviside layer by observations at Oxford on the interference of waves emitted by the Bournemouth broadcasting station and traveling by different paths. The results are of such interest that arrangements are being made for the repetition of the experiments and for further quantitative investigation of the effects of the ionization of the upper atmosphere, as indicated by Eccles' theory, recently developed by Larmor. Special attention will be paid to the effect of the earth's magnetic field on the propagation and the polarization of wireless waves.—*British Broadcasting Company, London, England.*

Radio Investigations

The correlation of theoretical and experimental values of effective resistance at radio frequencies and the measurement of radio-frequency current have been proceeded with. The standard sonometer has been set up, and a variable air condenser of new design has been constructed. A considerable amount of magnetic test work has been carried out in addition to the standardization of condensers and other instruments.—*National Physical Laboratory, London, England.*

Welded Samples, Fatigue Tests on

A number of samples are to be made up to be tested in a machine at the Bureau of Standards. These samples are to include riveted joints, double V-joints, single V-joints hand-welded, single V-joints automatically welded, lap-welded joints, single- and double-rivet welded seam joints, combined rivet-welded and seam-welded lap joints. Fatigue and other physical tests will be made at high temperatures and also with variation in temperatures.—*American Bureau of Welding, New York City.*

Suggestions for Research

Galvanometer, Pointer Type, Reading of, Through a Microscope

In the March 12 issue of *Science* (Vol. 63, page 283) Paul Kirkpatrick suggests the use of the microscope in reading a pointer-type galvanometer, especially in null methods. The sensitivity may be readily increased over fifty times, and in this way a more troublesome and delicate reflection-type galvanometer dispensed with.

Lamps, Quick Test on, Indicative of Life

At the present time lamps are tested for life under conditions of actual service. Such a test is slow and expensive, in energy, in labor and in lamps themselves. It is desired to develop a short test, preferably non-destructive, from which the expected life of a lamp could be predicted with reasonable accuracy.

Wave Propagation in Series-Connected Capacitors

Through the efforts of many investigators the problem of propagation of electromagnetic disturbances along parallel conductors has been well outlined, analytical difficulties ascertained, approximate solutions proposed and some of them actually carried out. It is now desired to make a similar study of finite capacitors connected in series. For example, let an electric device be connected to a transmission line through a string of insulators. When a wave of given steepness passes over the line, what kind of wave will start along the insulators and what will be the transient effect upon the connected device? Probably the calculus of finite differences will have to be used.

News of the Industry

Record Convention in View

All Roads Lead to Atlantic City—Several Changes Embodied in Final Program

WITH all electrical industry roads leading to Atlantic City and final preparations for the great convention of the National Electric Light Association complete, the outlook for a gathering next week that will break all records for attendance and enthusiasm is roseate. Some eleventh-hour changes in the program were found necessary to suit the convenience of speakers, and one or two additions have been made. The chief departures from the tentative program printed in the ELECTRICAL WORLD last week, on page 1020, follow.

At the second general session, on Wednesday morning, J. F. Shaughnessy, first vice-president National Association of Railroad and Utilities Commissioners, will speak on "The Growth of the Electric Light and Power Industry under Regulation." Bruce Barton will also speak at this session instead of on the following day, and Samuel Insull's address has been transferred to the fourth general session, on Thursday morning. Edwin Gruhl's part in Wednesday morning's session will be a talk on rate research, in his capacity as chairman of the rate research committee.

On Wednesday afternoon, when the third general session is to be held, Guy W. Talbot, president Pacific Power & Light Company, will speak on "Electric Range Facts for Utility Executives," taking the place of F. T. Griffith. The subject of Guy E. Tripp's address at the fifth general session, on Thursday afternoon, has been changed to "Restoring the Balance Between Industry and Agriculture." Other items not included in the general program as printed last week are the membership report of Howard K. Mohr at the first session and the lamp committee report of Frank W. Smith at the fourth.

The only change in the program of the sectional sessions is the inclusion of an address at the Commercial Section meeting on Tuesday afternoon by A. G. McKeever, president Ajax Trucking Company, New York, on "Why We Truck by Electricity."

Special meetings of national committees are scheduled on Monday, Tuesday and Wednesday, and on Thursday the directors of state public utility information bureaus will have a luncheon meeting at 1 p.m. in the Hotel Traymore.

General British Strike Affects Power Houses Little

The effect of the general strike precipitated in Great Britain last week upon that nation's supply of electrical energy appears to have been almost negligible as compared with the nine-day tie-up that prevailed in many of the fundamental branches of industry. As first reported, the only walk-out of power-house employees in London was in the Stepney district, where socialistic opinions are said to prevail. Later, when the struggle entered what was called its second phase, the crews of nineteen of the twenty-eight power houses in the metropolitan district went on strike. The government immediately replaced them by men from the war ships in the manner thus described by Sir Philip Gibbs, the famous war correspondent, in a dispatch to the New York *World* of Wednesday, May 12:

"Today I went behind the scenes in London's greatest power station, in Lots Road, Chelsea. From this station comes electrical energy which supplies all the underground railways and a considerable part of London's lighting system. If the engines ceased running here, London's heartbeat would receive an almost mortal blow. They have not ceased running for a half hour. Directly after the strikers marched out the government took control and sent in naval men from H. M. S. *Victory* and other ships. I found them working cheerfully and hard amid the throb and roar of mighty engines fed by automatic stokers which consume 800 tons of coal daily. Twenty thousand tons are held in stock and more coal is being unloaded, so that power will last for some time yet. A force of Grenadier Guards was posted about this great power house, and in addition every gate was guarded by special constables just recruited for police service and all looking like bank managers or prosperous city men."

Great Northern Electrification May Be Finished in Year

June of next year is announced by the Great Northern Railway as the possible date for the completion of the electrification of the section of its line passing over the Cascade Mountains in Washington from Appleyard to Goldbar. The power for this line will, as previously reported, be furnished by the Puget Sound Power & Light Company. The supply will be 110-kv., three-phase, 60-cycle, to the substation frequency converters, where it will be changed to 13,200 volts, 25 cycles, then stepped up to 44,000 volts, 25 cycles, for transmission along the railroad right-of-way. It will be stepped down at substations to 11,000 volts, single-phase, 25 cycles, for use on the trolleys. Motor-generator type locomotives with direct-current motors will be used.

Power Topics at Washington

Muscle Shoals Continues in Suspense—Eastern Tennessee Citizens Have Own Hydro Policies—Amendments to Swing-Johnson Boulder Dam Bill Are Proposed

BY PAUL WOOTON
Washington Correspondent ELECTRICAL WORLD

JUST how and when the Muscle Shoals bill is going to be brought before Congress for action has not been revealed, but Senator Deneen, the chairman of the joint congressional committee, is confident that a way will be found to dispose of this long-mooted question. If an agricultural relief bill is passed, it is not improbable that an effort will be made to attach the Muscle Shoals bill to it as a rider. As this is written, there is the possibility that an early opportunity will be found to take up the Muscle Shoals bill in the Senate on its own time.

There is a possibility that Senator Heflin, chief supporter of the American Cyanamide Company, may vote for the acceptance of the pending offer of the Southern power companies. He is said to believe that with certain amendments it can be greatly in the interest of agriculture to support this bill and that it should be perfected and passed at the earliest possible date, despite bitter opposition from north Alabama, which had had dreams of becoming a great industrial center. Senator Underwood, however, apparently cannot abandon the idea of operating plant No. 2. He seems to think that that plant is essential to the national defense. None would be surprised were he to offer the Cyanamide bid as a substitute when the power companies' proposition comes before the Senate. In the House there has been a tacit agreement to await the action of the Senate.

East Tennessee Citizens Act on River Problem

Development of the power resources of the Tennessee River under the federal water-power act is demanded by East Tennessee Associated, an organization of citizens of Eastern Tennessee "to promote common welfare" in that region. In a recent letter sent to members of the Senate that organization condemns the desire of electrochemical applicants for a lease of the Muscle Shoals plants to control Cove Creek, 400 miles upstream. To assent to this proposal, the association says, would deprive eastern Tennessee of 260,000 hp. existing in that region. The letter concludes:

"We have excellent reason to feel

confident that if Congress does not adversely intervene, these water-power resources will be developed speedily, under our own sovereign control and regulation, so that they will give ot us all of the economic advantages that they are capable of producing and at the same time add to the capacity of the Muscle Shoals power sites to a far greater extent, through river regulation, than could possibly be accomplished by carrying out the proposal of the electrochemical organization."

Proposed Amendments to Swing-Johnson Bill

The favorable action taken by the Senate committee on the Swing-Johnson bill for the Boulder Dam development on the Colorado River seems to have had no effect on the deadlock in the House committee, and the revised proposal has not yet been able to command a majority vote there, despite the full weight of administration influence to that end.

Some amendments to the bill proposed by Representative Leatherwood of Utah are to the following effect:

1. Dam and appurtenant structures to be built by and at the expense of the United States.

2. Power-plant and appurtenant structures to be built by and at the expense of licensee or licensees, the license or licenses therefor to be issued by the Federal Power Commission under the terms of the federal water-power act as is authorized in all other cases of government-owned dams.

3. Reservoir to be operated primarily in the interests of flood control, irrigation and domestic water supply, with power permanently subservient to such uses.

4. Control of reservoir levels of storage of water therein and the discharge of water therefrom to be within the exclusive jurisdiction of the Secretary of the Interior.

5. Exclusive authority in the Secretary of the Interior to fix an amount of rental under such license sufficient, in his judgment, to meet the financial obligations assumed by the United States and the retirement of the moneys expended on the construction of the dam and appurtenant works.

6. All matters of administration with respect to irrigation, flood control and domestic water supply to be within the exclusive jurisdiction of the Secretary of the Interior.

7. All administrative matters with respect to the power plants and their operations to be in the exclusive jurisdiction of the Federal Power Commission except as modified by paragraphs 3, 4 and 5.

Ontario and Quebec Agree on Hydro Export Policy

The promised conference between Premier Ferguson of Ontario and Premier Taschereau of Quebec has been held, and the result announced is an agreement providing for the immediate appointment of a joint engineering board to survey and report upon the power possibilities of the Ottawa River, the remission by Quebec in Ontario's favor of the tax of 50 cents a horsepower upon output, and joint resistance to any action by the Dominion government to lease or sell the Carillon or any other Ottawa site.

The remission of the power tax will mean a saving of $130,000 a year to Ontario when that province obtains delivery of the 260,000 hp. from the new International Paper development near Ottawa. The new board will be expected to recommend a plan of development which will divide potential horsepower equitably between the two provinces.

More About New Indianapolis Holding Company

Further details concerning the acquisition of control of the Indianapolis Light & Heat Company by the newly organized Indianapolis Power & Light Corporation, reported last week, (page 1022), are to the effect that the majority stock in the Indianapolis company was acquired by the Harley L. Clarke interests in association with a number of Eastern banking concerns. According to reports in Indianapolis financial circles, Mr. Clarke and his associates, who formed the holding company, agreed to pay $500 in cash in addition to $125 worth of second preferred stock in the holding company for each share of stock disposed of by them.

N. A. Perry, secretary of the company, declined to comment on the report of the second preferred stock bonus, but said that a statement on that phase of the transaction would be issued when the deal was completed. He denied that there had been an outright sale of the Marmon and Perry common holdings to the Clarke syndicate. Charles N. Thompson, vice-president of the company, admitted that a bonus of second preferred stock had been offered, but said that other arrangements might be made before the final closing of the transaction. He declined to comment upon the report of the disposal of the majority common stock to the holding company.

The formation of the new corporation, according to Walter C. Marmon, president of the Indianapolis Light & Heat Company, was made for the purpose of keeping that company in its present sound financial condition and of facilitating new development work and extensions of service which, under provisions of the charter of the Indianapolis Light & Heat Company, might have led to litigation. Officials of the company frankly asserted that the new corporation has for its chief purpose a counter move against the Insull interests, which, it is believed, sought to bring about consolidation in the Hoosier capital.

The Indianapolis Power & Light Corporation has an authorized stock issue fixed at 403,000 shares of no par value, of which 100,000 shares are preferred and 53,000 are second preferred. In the transfer of stock to the new corporation shareholders are to be given their proportionate holdings in the new corporation, and the control of this holding company, it is said, will remain in the hands of Walter C. Marmon, N. A. Perry and their associates.

Hoover Commends Non-Competitive Status of Utilities

Speeches by Secretary Hoover, Owen D. Young and many other men prominent in administrative and industrial fields signalized the fourteenth annual meeting of the Chamber of Commerce of the United States, held at Washington this week. The major topic of consideration was "Self-Government in Business." Mr. Hoover, stressing mass production, found a text in the regulated, non-competitive status of public utilities, saying on this point:

"We have found that to maintain complete competition in the utilities—transportation, light, power and communication—meant a fabulous cost in duplicating equipment, with less financial stability, increased operating expenses, poorer service and increased rates to the consumer. The federal government and most of the 48 states acting independently have abandoned competition reaching to each consumer of these services as the method of holding down rates and holding up service and have established regional monopolies. A considerable element of direct or indirect competition still exists, for there are alternate services that can in a large sense be made available—other railways, other forms of power, other forms of light, etc.—so that the stimulus to improvement is still held. When we deliberately clothe industry with the security of part monopoly, neither the industry nor the public disputes the necessity of full control of rates, service and finance by government agencies. Both the public and the utilities have gained from the change—the public in better and cheaper service, the utilities in more stable earnings.

"Our ideas in the other trades, however, are a good deal muddled. . . . Although we have relaxed somewhat, we do not allow many forms of collective action to eliminate definite wastes, even though such collective action may be obviously in the public interest and productive of a fundamental strengthening of competition itself. But competition does not necessarily imply destructive competition."

Iron and Steel Men Will Meet at Chicago June 7-10

The twenty-second annual convention of the Association of Iron and Steel Electrical Engineers will be held at the Hotel Sherman, Chicago, from June 7 to 10, in connection with the usual iron and steel exposition. Everything, the association announces, will be under one roof. The tentative technical program includes a safety congress on Monday, June 7, when the association's recommended rules for the safe operation of electric overhead traveling cranes will be discussed. On Tuesday the topics will be standardization of mill-type motors and tests in connection with the uniflow engine built by the Nordberg Engine Company; on Wednesday, refractories for the iron and steel industry and the report of the electric heat committee; on Thursday, electric transportation in yards, mills, shops and factories. On Friday there will be an inspection trip.

Carl Hering Dies Suddenly

Philadelphia Engineer Had Signal Achievements to His Credit, Particularly in Electrochemistry—Former President of A.I.E.E. and "Electrical World" Editor

AN OUTSTANDING figure in electrical engineering circles was removed on Monday, May 10, by the sudden death of Carl Hering, long a consulting engineer in Philadelphia. Dr. Hering, who resided at the Engineers' Club, had entered the Hahnemann Hospital, which was founded by his father, on the Saturday before his death to rest and receive treatment for what he thought a slight affection of the heart. He had improved rapidly and was chatting with his physician ten minutes before death, which struck him down as he was in the act of picking up a telephone receiver.

Born 66 years ago in Philadelphia of German parentage and educated in that city and in Germany, Carl Hering had a distinguished career as a leader in the technical branch of the electrical art, which in its modern form sprang into being just as he arrived at manhood. In the electrochemical and electrometallurgical fields especially he achieved international distinction, his discovery of the "pinch" effect being his greatest accomplishment, though by no means his only one. In 1892 he served as technical editor of the ELECTRICAL WORLD, and a year later he originated the "Digest of Current Electrical Literature," which has ever since been a prominent weekly feature of the periodical. This department he conducted for ten years, abstracting all the notable articles on electrical science printed in the technical papers of the world and bringing wide recognition of the Digest as an indispensable record.

PIONEER ELECTRICAL STUDENT

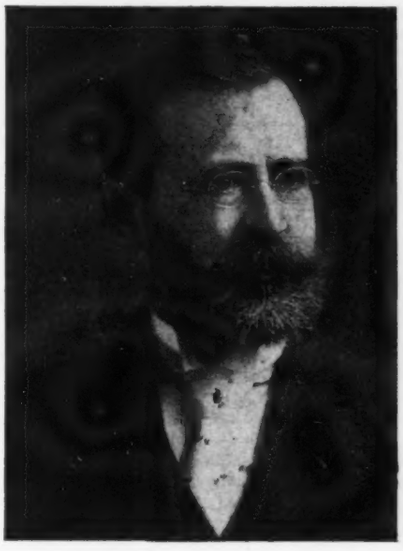
Carl Hering was graduated from the University of Pennsylvania in 1880 in mechanical engineering, receiving the degree of bachelor of science with high honors and seven years later the postgraduate degree of mechanical engineer. In later years the university conferred on him the honorary degree of doctor of science. In 1882, while teaching at the university, he began the study of electrical engineering. In 1883 he published his first technical article, the precursor of a long series of writings, including at least eight books and innumerable papers read before technical societies and contributions to the engineering press.

He journeyed to Europe in the same year as a member of the jury of an international electrical exhibition in Vienna, and no less than eleven similar assignments fell to his lot in after years, both in Europe and at home, hardly an international or otherwise important exhibition associated with the electrical art being held without his participation. He began a course in electrical engineering at Darmstadt, Germany, in 1884 and was soon made assistant to the professor, a pioneer in that branch of knowledge. In 1885 he became chief electrical engineer for a German manufacturing company which made and installed motors and dynamos, but he soon returned to his native country, where as early as 1886 he began practice as a consulting electrical engineer in Philadelphia, having thus lived to complete 40 years in this occupation.

WORK IN CHEMICAL FIELD

A man of many attainments, Dr. Hering was all his life an enthusiastic searcher for a scientific explanation of apparent exceptions to generally accepted physical laws, and as an outcome of this trait he became a stickler for the correct expression of scientific results in standard units and contributed considerably to the construction and classification of electrical nomenclature.

Dr. Hering's work in electrochemistry



CARL HERING

began with extended researches into storage batteries prior to 1890, as a result of which he obtained numerous patents. He also investigated the commercial regeneration of spent battery solutions. His electric furnace work dates back to some tests in 1900 for the reduction of arsenic ore. Some six years later, while designing and operating electric furnaces, he began a series of experiments which resulted in the announcement of the discovery of a new internal electromagnetic force tending to contract a conductor through which current is flowing even to the extent of rupture when it is a fluid. This discovery was the "pinch" effect, already referred to. He later demonstrated the existence of other effects showing that the electromagnetic forces act on the material of the conductor. In 1909 he applied these forces to impart rapid motion to masses of molten material and on this principle invented an electric furnace which is now in wide commercial use.

As early as 1883 he began the computation of conversion factors of electrical and mechanical energy, and he published a comprehensive book on this subject in 1904. A few years later he made a recalculation of all electrochemical equivalents. In 1908 he made an analysis of the interrelations of the various quantities of units entering into the calculation of light phenomena. In the same year he described an experiment purporting to demonstrate a hitherto unrecognized factor in electromagnetic induction to show that Maxwell's well-known law of induction should be modified in order to acquire the status of a universal law.

Dr. Hering was one of three men who in 1901 laid the plans for the organization in the following spring of the American Electrochemical Society. He was also concerned in the founding of *Electrochemical Industry*, now *Chemical and Metallurgical Engineering*, published by the McGraw-Hill Publishing Company, Inc. In 1900 he was elected president of the American Institute of Electrical Engineers and presided at a session held abroad. In 1904 he served as president of the Engineers' Club of Philadelphia, and in 1906 of the American Electrochemical Society. Among other technical organizations to which he belonged are the American Association for the Advancement of Science, the Franklin Institute and the Illuminating Engineering Society. He is survived by a daughter and by several brothers and sisters.

Funeral services were held at Philadelphia on Thursday afternoon.

Bill Permitting Hydro Plant on Genesee Approved

Plans for the proposed power dam in the Genesee River near Mount Morris, by which the Rochester Gas & Electric Corporation expects to produce up to 60,000 hp. intermittently, depending upon the height of the water, are in the hands of the New York State Engineer for examination, the last legal obstacle in the way of constructing the dam having been removed when Governor Smith signed a bill giving the Mount Morris Water Power Company permission to undertake this work and also to change the flow of the Genesee River near Letchworth Park. The date for beginning the work on the power dam has not been set. The entire project will cost approximately $10,000,000.

Electrical power developed by the power dam at Mount Morris will be brought to Rochester for industrial use, where it will augment the 30,000 hp. steadily developed at the falls in the Genesee at that city and create a surplus of power which it will require four years for Rochester to absorb by normal growth. The surplus will be utilized at points along the line between Mount Morris and Rochester temporarily.

The bill also authorizes the Governor to accept deed to 500 acres of land from the Mount Morris Water Power Company on condition that it be used for public park purposes. This land lies along the Genesee River at the point where the dam is to be built and where its construction will result in the formation of a large artificial lake. It is specified in the deed that the people of the state may use this lake for boating and other sports.

Purchases and Mergers

Appalachian Electric Power Company and General Public Utilities Company Are Formed

THE Appalachian Electric Power Company, recently formed, will consolidate electric power systems in Virginia, West Virginia and Kentucky. The power plants serving these systems already are connected by transmission lines. The properties going into the consolidation are the Consolidated Power & Light Company of Huntington, W. Va.; West Virginia Water & Electric Company of Charleston, W. Va.; Dunbar (W. Va.) Light & Power Company, St. Albans (W. Va.) Electric Light & Power Company, Interstate Power Company of Hartland, W. Va.; Kentucky & West Virginia Power Company of Huntington, W. Va.; Appalachian Power & Light Company of Charleston, W. Va.; Appalachian Power Company of Bluefield, W. Va.; Roanoke (Va.) Railway & Electric Company, Lynchburg (Va.) Traction & Light Company, New River Development Company of Pearisburg, Va.; Central Virginia Power Company, Boyd County Electric Company of Ashland, Ky., and Kanawha Valley Power Company of South Charleston, W. Va. The entire southern half of West Virginia, the western half of Virginia and a part of eastern Kentucky are now being served by these companies, which will be under the supervision of the American Gas & Electric Company. Their territory includes 250 communities.

The General Public Utilities Company is a new utility chain owned and managed by Day & Zimmermann of Philadelphia and operating directly or through subsidiaries electric, ice and water plants. Grouped in the new company are the Southwestern Public Service Company of Carlsbad, N. M., operating in New Mexico, Arizona and Texas; the Gulf Public Service Company, operating in Louisiana; the Consolidated Power & Light Company of South Dakota, with headquarters in Deadwood; the Dakota Power Company of Rapid City, S. D.; the Nebraska Light & Power Company of McCook, Neb., and the Gothenburg (Neb.) Light & Power Company.

Permission is sought from the Nebraska State Railway Commission for the consolidation of the Nebraska Gas & Electric Corporation of Lincoln and the Blue River Power Company, which, with headquarters at Seward, serves 30 communities directly or by wholesaling energy. Both companies are subsidiaries of the United Light & Power Company, Chicago.

A petition asking authority to purchase the French Lick & West Baden Water, Light, Heat & Power Company for $500,000 has been filed with the Indiana Public Service Commission by the Interstate Public Service Company of Indianapolis, an Insull utility. The Interstate company, it is understood, plans to connect West Baden and French Lick with a large power plant at Edwardsport, Ind., by a long transmission line. The petition sets out that intermediate towns, including Bedford, Mitchell, Orleans, Paoli, Shoals and Loogootee, will be served from the same line.

Purchase of the Halfmoon Light, Heat & Power Company of Mechanicville, N. Y.; the Salem Light, Heat & Power Company and the Dwaas Electric Company of Hudson Falls by the Eastern New York Electric & Gas Company of Granville has been authorized by the Public Service Commission, which has also approved the transfer to the New York State Gas & Electric Corporation of the franchises and plants of the Roxbury Light & Power Company, the Brookfield Electric Light & of West Burlington and Fred L. Nelson Power Company D. Thorne Gardner of Deansboro. In the case of the Brookfield company the generating plant and equipment are excepted from the transfer. About $36,000 was involved in the purchase of these plants.

The Western New York Utilities Company has asked the commission for consent to transfer its electric distribution system in the town of Royalton and the village of Middleport to the Lockport & Newfane Power & Water Supply Company of Middleport. The price named is $100,000.

The Consolidated Water Power Company of Wisconsin Rapids, Wis., has applied to the Railroad Commission for authority to issue $2,000,000 in bonds for the purpose of taking over the Wisconsin Rapids and Biron waterpower developments of the Consolidated Water Power & Paper Company.

Fitkin Utilities, Inc., have announced the purchase of electric and ice plants in southern Missouri and northeastern Arkansas, including properties at Steele and Campbell, Mo., and Luxora and Osceola, Ark. All the companies are in an area served by the Arkansas-Missouri Power Company, a Fitkin property, with which the new acquisitions will be connected.

The Henry L. Doherty interests have purchased the assets of the Taney Light & Water Company of Branson, Mo., which has been furnishing light and power to Branson, Hollister, Forsyth and numerous resorts on and adjacent to Lake Taneycomo and has received its energy from a hydro-electric plant on the White River.

Approval is sought from the Illinois Commerce Commission for the merger of the Cherry Valley Light & Power Company and the Drager Electric Company of Winnebago, Ill., with the Roscoe Electric Company. The Cherry Valley properties are valued at $20,000 and the Drager concern at $25,000.

The citizens of Nacogdoches, Tex., voted on May 7 to sell the municipal electric light and power plant to the Texas Power & Light Company for $150,000 cash. Nacogdoches will be served from the company's station now under way at Trinidad.

Projects Before the Federal Power Commission

The city of Twin Falls, Idaho, has applied to the Federal Power Commission for a preliminary permit covering a 7,000-hp. development on Snake River in Twin Falls County.

The Utah Power & Light Company has applied for a license to cover its constructed plants on Upper and Lower Mill Creek in Salt Lake County, Utah.

Shuford & Saxton of Charlotte, N. C., have applied for a preliminary permit covering a project on Wilson Creek in Caldwell County, N. C. A head of 80 ft. is to be developed. The power is to be used at a manufacturing plant.

Governor Gore of West Virginia has lodged vigorous objection to the conclusion of War Department engineers that the large power development proposed on New River near Radford, Va., by the New River Development Company does not affect the federal interest. The engineers of the Federal Power Commission believe the project should come within the commission's jurisdiction. While New River is not navigable, it is contended that the operating waves will affect navigation in the Kanawha River, of which it is a tributary. The report has been returned to the Chief of Engineers for a further investigation.

Hold Convention by Mail

Wisconsin Utilities Association's Novel Plan Obviates Usual Annual Gathering

SUBSTITUTING the post office for the hotel meeting room, a convention by mail has just been held by the Wisconsin Utilities Association in lieu of the usual annual gathering. Its proceedings are reported in the form of a bulletin edited by John N. Cadby, executive secretary of the association. This bulletin contains the reports of the officers and of the sixteen chairmen of sections and committees. Necessarily, all the reports are in a more condensed form than they would have been had they been delivered as usual.

George H. Wilmarth, retiring president of the association, in his annual report, explains that the successful development of the sectional conventions of the association made it unnecessary to hold the usual general convention. He reports that 625 utility men attended the various sectional conferences during the past year, saying that these meetings were attended largely by department heads who were vitally interested in the subjects on the program and that the exchange of opinions and experiences proved to be of greater benefit to companies and personnel than the former general convention method.

Other correspondence convention reports are made by G. G. Post, A. F. Herwig, H. L. Geisse, Nels Rasmussen, S. B. Sherman, A. A. Cavanaugh, D. T. Montgomery, Florence Clark, L. M. Williams, John St. John, K. F. McMurry, I. L. Scott, H. A. Smith, T. F. Keefe and C. R. Phenicie. Secretary Cadby reports that 42 gas, electric and railway companies in the state are members of the association.

Balloting for officers was also carried on by mail with these results: President, John St. John, vice-president Madison Gas & Electric Company; vice-president, John Anderson, power engineer Milwaukee Electric Railway & Light Company; treasurer, G. C. Neff, Madison, vice-president Wisconsin Power & Light Company; chairman Public Relations Section, C. R. Phenicie, Green Bay vice-president, Wisconsin Public Service Corporation; vice-chairman, W. C. Lounsbury, general manager Superior Water, Light & Power Company.

A. I. E. E. at Madison, Wis.

Regional Meeting Discusses Cables and Rural Electrification—President Glenn Frank Speaks

A SYSTEM for practical comparison of the probable service life of high-voltage cables, a review of cable-testing methods, rural electric service and co-operation between colleges and industry were the chief topics discussed at the regional meeting of the American Institute of Electrical Engineers held at Madison, Wis., May 6 and 7. This was the first regional meeting held by the Great Lakes District of the Institute. The attendance was 180.

The system for rating cables according to their grade in meeting certain test and inspection requirements was described by D. W. Roper and Herman Halperin, Commonwealth Edison Company, in a paper entitled "The Quality Rating of High-Tension Cable with Impregnated Paper Insulation." The general principle of this paper was heartily indorsed by those who discussed it. By correlating test and service data it established in a rather definite way a method of classifying cables and of predicting their probable behavior in service. There were some questions as to the relative weights that were allotted to certain attributes of cables. R. W. Atkinson, Standard Underground Cable Company, thought that low dielectric loss, the ratio of puncture voltage of bent to straight samples and uniformity of insulation resistance should not be overemphasized and that the kind of compounds should not be specified.

W. A. Del Mar, Habirshaw Electric Cable & Wire Corporation, thought that uniformity of insulation resistance was not as important as indicated in the paper. In answer to this Mr. Halperin said that whenever wide variations in insulation resistance had been found other defects were also found. Mr. Del Mar and a number of others pointed out that conditions in Chicago are exceptional and that other cities do not have the same requirements, especially as regards high voltage and low insulation thickness. W. S. Clark and E. S. Lee, General Electric Company, recommended that an accelerated life test be included in the rating system, advocating five-minute intervals with comparatively large voltage increases, possibly 15 per cent per step. Mr. Roper thought that it would be better to use such tests as a parallel check. Mr. Lee also pointed out the uncertainty of such a rating method, drawing attention to the fact that the particular cable which had the highest total rating in the paper had low grades on all the points of comparison except one. Others discussing the paper were D. M. Simons, R. J. Wiseman, H. G. Burd and S. J. Roesch.

HIGH-TENSION CABLE TESTS

The paper on various tests and testing methods, entitled "Tests of Paper-Insulated High-Tension Cable," was presented by F. M. Farmer, Electrical Testing Laboratories. In commenting on this paper Capt. Percy Dunsheath of W. T. Henley's Telegraph Works, England, said that the rise of power factor with time in insulation tests might be attributed to increase of hydrostatic pressure resulting from rising temperature. He also advocated standardizing the method of preparing the cable ends for tests. W. S. Clark also thought that temperature should be considered, since it modifies results considerably. Both Mr. Clark and Herman Halperin, the first as a result of operating records, denied that high-frequency surges are responsible for failure of good cable. S. J. Roesch recommended that more tests be made on full cables instead of samples, advocating tests at 30-minute intervals with the present voltage increments. Mr. Roper said that full-reel tests will take 1 per cent to 2 per cent of the life of a cable, but that they are worth while. Mr. Del Mar asserted that the tests advocated for stability of compounds did not give consistent results, according to his experience. E. C. Willman, Cleveland Electric Illuminating Company, mentioned tests which showed that the substance called "x" is formed by the action of ultra-violet light.

W. A. Del Mar presented a paper on "The Effect of Internal Vacua in High-Voltage Cables." Captain Dunsheath in discussing this paper said that satisfactory 33-kv. cables can be made without oil ducts. F. A. Brownell, Public Service Production Company, mentioned that a number of cable failures had occurred on his system when cables which had been idle during the night were put into service early in the morning, which might indicate that the cause of failure was the formation of voids when the cables cooled at night. E. M. Tingley suggested as a method of preventing ionization troubles that the compound might be kept continually flowing through the insulation at a low speed. Such a suggestion applied only to expensive cable of very high voltage.

UNIVERSITY MEN PARTICIPATE

Two papers on rural electric service were presented — "Rural Electrification," by G. C. Neff, Wisconsin River Power Company, and "Important Features of a Successful Plan for Rural Electrification," by G. G. Post, Milwaukee Electric Railway & Light Company. These were discussed by E. A. Stewart of the University of Minnesota, A. H. Ford of the University of Iowa, E. W. Lehmann of the University of Illinois, F. W. Duffee of the University of Wisconsin, K. A. Pauly, Eugene Holcomb and Commissioner C. B. Hayden of Wisconsin.

There was also a symposium on co-operation in research between the colleges and the industries, to which contributions were made by W. E. Wickenden of the Society for the Promotion of Engineering Education, Dean A. A. Potter of Purdue University, B. F. Bailey of the University of Michigan and Edward Bennett of the University of Wisconsin. The informal discussion was participated in by E. B. Paine of the University of Illinois, F. E. Tourneur of the University of Wisconsin, C. F. Harding of Purdue University, John Mills, S. H. Mortensen and J. S. Coldwell.

Two other papers were "Some Interconnected-System Operating Problems," by F. G. Boyce, Consumers Power Company, and "Behavior of Radio Receiving Systems to Signals and to Interference," by L. J. Peters, Wisconsin University.

An important feature of the meeting was an address given at a dinner on the evening of May 6 by Dr. Glenn Frank, president of the University of Wisconsin. Dr. Frank advocated a "new scientific renaissance," which, he thought, could be accomplished by makig the knowledge of researchers in all lines of science available for common understanding and for practical use, and also favored a "new industrial revolution" to decentralize industry, regularize production and distribution and promote security in employment.

Coming Institute Meetings

A.I.E.E. to Convene at Niagara Falls in May and White Sulphur Springs in June

TWO items have been added to the program for the regional meeting of the American Institute of Electrical Engineers at Niagara Falls, N. Y., May 26-28, as printed in the ELECTRICAL WORLD for April 24 (page 885). These are a paper by Thomas Spooner, Westinghouse Electric & Manufacturing Company, on "Current Transformers with Nickel-Iron Cores," and a short talk on "The Calibration of Lichtenberg Figures" by K. B. McEachron of the General Electric Company, Pittsfield.

As previously reported, the technical proceedings will include a symposium on measurement of dielectric power factor, papers on transmission, tests of hydro-electric units, rectifiers, transformer design, polarization of radio waves, armature reactance, magnetic-flux measurements, current transformers, supervisory control and fire protection for generators. The steamer trip on Lake Ontario has been set for Wednesday evening, May 26. A trip to the Niagara Gorge will be made on Thursday afternoon, and on the evening of that day the convention dinner will be held at the Niagara Hotel, when President Pupin, E. D. Adams, C. C. Chesney, Giuseppe Faccioli, H. M. Hobart and others will speak briefly. Following the dinner a lecture, with demonstrations, on "Modern Reproduction of Sound" will be delivered by L. T. Robinson. A special illumination of the Falls will take place on Thursday night. On Friday evening Prof. V. Karapetoff will give a piano recital, and it is hoped to have the first exhibition of a new film of the Niagara Falls Power Company as an accompaniment to a lecture by George S. Anderson of that company on possible future power and scenic developments at the Falls.

The program for the forty-second annual convention of the Institute at The Greenbrier, White Sulphur Springs, W. Va., June 21-25, is not yet ready. It has been determined, however, to include papers on such subjects as magnetization, remotely controlled substations, high-speed circuit breakers, electric transients, machine windings, regenerative braking, non-harmonic alternating currents, theory of synchronous machines and heat transfer in machines. Besides the reports of the technical committees, there will be, it is planned, addresses by representatives of the American Engineering Council and the American Engineering Standards Committee. Afternoons will be free for recreation.

Proposes Two-Stage Plant on St. Lawrence

Plans of American Super-Power Corporation Would Afford Continuous Output of 1,600,000 Hp. at Cost of $154,000,000 —New York Power Commission May Act

RELATIVE merits of a two-stage development as against a one-stage development of St. Lawrence River power, with the inference that the Canadian government favors the former, were argued before the New York State Water Power Commission on May 6 in a hearing on the application of the American Super-Power Corporation for a preliminary permit to develop power at the lower end of Ogden Island between the town of Waddington, N. Y., and Morrisburg, Canada, and at the foot of Barnhart Island between the town of Massena, N. Y., and the Canadian shore. Some particulars concerning the Niagara plans of this company were printed in the ELECTRICAL WORLD for April 24, page 877.

The installed capacity contemplated for the St. Lawrence under the Super-Power Corporation plan, which is designed for execution in co-operation with the Canadian authorities, is 1,950,000 hp., to afford a continuous output of 1,600,000 hp., and the estimated total capital cost is $154,092,512 for the two-stage development, or at the rate of $96 per horsepower. The estimated time to complete the work of the first stage is set at three years as against 54 months for a single-stage development. Attorney-General Ottinger declared that the commission, of which he is chairman, would not give any consideration to priority of application, but would give special attention to the plan which in its opinion would insure speedy development at the most economical cost and in the most feasible manner.

F. C. Hamilton of Henry L. Doherty & Company, Inc., New York City, testified that the present directors of the American Super-Power Corporation include R. W. Gardner, vice-president Otis Elevator Company, retired; Henry L. Doherty and A. B. Leach, New York; John M. McDonald, Buffalo; J. Boardman Scoville, Paul T. Brady, representative of the Westinghouse Electric & Manufacturing Company, New York, and Edward C. Randall, president of the company. Henry L. Doherty is chairman of the board of directors, and it was asserted that this group of men can and will finance the undertaking if a permit is granted.

Colonel Hugh L. Cooper was present at the hearing as a spectator. Walter S. Connelly, president of the New York & Ontario Power Company, presented evidence of certain power rights on the St. Lawrence River concerning which his company desires protection.

Attorney-General Ottinger said: "We want to proceed immediately. There has been enough time wasted in delays already. The Frontier Corporation has gone ahead on that assumption and has applied for a license to proceed with the development. Speed is essential." This statement was taken as an indication that the Water Power Commission before it goes out of existence on Jan. 1 will grant a permit to develop the water power on the St. Lawrence. It is predicted, however, that this permit will be issued to the Frontier Corporation, whose application was heard earlier in the year as reported at the time in these columns in February, March and April. The Frontier Corporation, which originally contemplated a two-stage plant, now plans a single-stage development.

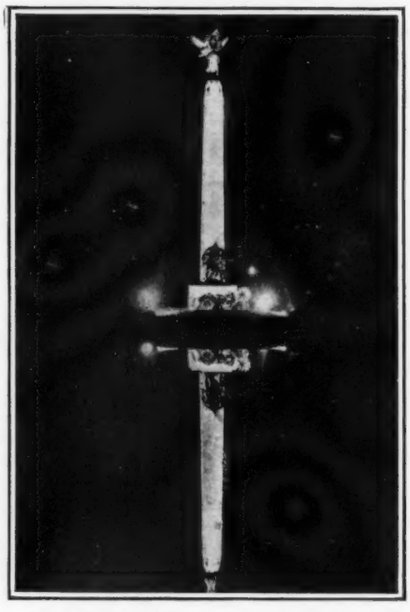
The commission adopted a resolution granting to the United Paper Board Company, Lockport Paper Company, Niagara Paper Mills, Tuscarora Hydraulic Company, Electric Smelting & Aluminum Company, Lockport Felt Company and Lockport & Newfane Power & Water Supply Company permission to use surplus waters of the Barge Canal spilled into Eighteen-Mile Creek at Lockport at an annual rental of $1,500, which price was accepted for the companies.

A.S.M.E. Providence Meeting Has Power Session

Technical problems of the boiler plant occupied an important place on the program of the American Society of Mechanical Engineers' convention at Providence, R. I., from Monday to Thursday of last week. At a central-station power session Wednesday morning, presided over by Nicholas Stahl, superintendent of operation Narragansett Electric Lighting Company, Nevin E. Funk, operating engineer Philadelphia Electric Company, presented a paper on "Comparative Performance of Air Preheaters." A paper by H. W. Leitch, general superintendent of power plants, United Electric Light & Power Company, New York, on "Boiler and Stoker Performance at the Hell Gtae Station" followed, and B. H. B. Reynolds, Interborough Rapid Transit Company, New York, abstracted a paper by R. S. Lane, J. M. Taggart and himself on the new boiler equipment of the Interborough Fifty-ninth Street station, presented at an earlier meeting of the society in New York.

Mr. Funk submitted extended data on the use of air preheaters in operating service, with comparisons of plate and tubular types. Without reaching final conclusions, the author's observations indicated superior performance of the tubular type with the designs and under the conditions described. Both types of heaters were warmly defended in the discussion, which emphasized the trend toward the use of water-cooled furnace walls and suggested the desirability of further test data in the latter connection. Mr. Leitch's paper showed the importance of striving to attain standards of operating efficiency comparable to test efficiency in large boiler plants, and pointed the way toward this through perfected control of combustion, designs requiring a minimum of maintenance, better meeting of load variations and reduction of investment by increasing the overload capacity of the evaporating surfaces and coal-burning equipment, with other improvements in design.

Montclair, N. J., Floodlights Its Soldier Memorial



RISING 60 ft. above the surface of a lake in Edgewater Park is the memorial which Montclair, N. J., has erected to the memory of her soldier dead. It is a plain granite shaft superimposed on a granite base. On the front of this base and surmounting the column are symbolic figures. At night twelve General Electric 500-watt floodlighting projectors illuminate the monument and the water reflects its outlines.

Briefer News

Beloit (Wis.) Water, Gas & Electric Company Loses Identity.—At a special meeting of stockholders of the Beloit Water, Gas & Electric Company recently it was determined to discontinue the name of that company. It will hereafter be entirely absorbed in the Wisconsin Power & Light Company, which took it over not long ago, as previously reported.

Maine Company to Build New Power House.—Contract for the erection of a new power house at West Buxton, Me., to cost approximately $500,000 when completely equipped, has been awarded by the Cumberland County Power & Light Company. The new plant will be 1,000 ft. from the company's present plant and will be so built that both plants may be operated as a unit. It forms part of a reconstruction and rehabilitation program which has been in progress since 1922, when the first unit of the steam plant was built at South Portland.

Rochester Gas & Electric's New Office Building.—The Rochester (N. Y.) Gas & Electric Corporation has just moved into its new ten-story office building in East Avenue. This structure, which is a massively constructed building of reinforced concrete, has

been in process of erection since last summer. The main floor will be occupied by the cashier's office, salesroom and service departments. The entrance is through a marble lobby, from which there is elevator service to the upper floors, where office space is leased, among the tenants being the General Electric Company, the Westinghouse Electric & Manufacturing Company and other electrical firms.

Detroit to Improve Street-Lighting System. — The budget of the Public Lighting Commission of the city of Detroit calls for an expenditure in the new fiscal year of $772,581, of which $350,000 is to provide improved street and park lighting, including the erection of about 350 new standards.

Baltimore May Undertake Small Lighting Plant.—Baltimore is to build a water-storage dam at the juncture of the Prettyboy and Gunpowder Rivers, and in connection with this undertaking the question of developing energy for city uses has come up. It is pointed out, however, by the head of the Bureau of Water Supply, V. Bernard Siems, that the available water flow, when the impounding works are completed, will not generate more than 750 hp. and that such a small amount of power would serve only to light the area about the dam and some few dwellings in the neighborhood and could not possibly aid materially in reducing municipal expense.

Oklahoma Gas & Electric Again Cuts Rates.—A voluntary reduction of 5 per cent in lighting rates in all of the towns connected to the system of the Oklahoma Gas & Electric Company except seven small communities was made on May 1. Users of electricity in sixty cities and towns will immediately benefit. This is the second revision downward of the company's electric rates within the past year, the former cut having been voluntarily made to large users. Officials of the company say that the reduction just made, as well as the previous cut, was made possible through the revocable-permit legislation passed a year ago by the Legislature, under which the electric company has been able to finance with greater facility and at a lower cost.

Nebraska Hydro-Electric Project Gets Conditional Approval.—Over the protests of the Tri-State Utilities Company, which maintained that competition was unnecessary in northeastern Nebraska, the Nebraska State Railway Commission has given the Northern Nebraska Power Company permission to issue $200,000 common stock at par, and when it has done this it will be permitted to sell $470,000 of 8 per cent preferred stock, provided that the subscription blanks shall prominently set forth that the approval of the stock issue is not to be taken as indorsement of the stock by the commission. The Northern Nebraska Power Company is an organization of Nebraskans who have been managing plants in various parts of the state. They purpose installing a hydro-generating plant on the Niobrara River, near Spencer, and running two transmission lines into adjacent territory, to supply sixteen towns, besides selling energy at wholesale. Some of these villages are now served by the Tri-State company and other municipalities.

California Municipalities Have First Right to Water.—In approving the application of the East Bay Municipal Utility District for appropriation of water from the Mokelumne River for domestic purposes the California State Division of Water Rights ruled on a point in the state water law which has not heretofore come up. The law provides that the right of a municipality to the appropriation of water for domestic purposes takes precedence over all other applications whether or not they are first in point of time. In the case of the application of the East Bay Utilities District the division ruled that this utility is a municipality within the meaning of the law and as such has preferental right to the use of water over other pending applications.

Red Wing (Minn.) Experimental Farm Discussed.—The experimental rural electric line extending from the Northern States Power Company plant at Red Wing, Minn., to nine farms north of that place was the chief topic of the ninth and last district meeting of the North Central Electric Association, held at Red Wing May 10. The program was in charge of Charles W. Loring, manager of the plant. Prof. E. A. Stewart reported on the project and outlined plans for standardizing procedure in establishing rural electric lines in the future. He said the work had given results which indicated that there are several ways of making electricity pay more than its cost. A meeting of power company executives will be held later to consider co-operative action in establishing uniform methods of handling rural power lines.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 2, page 80.]

National Electric Light Association—Atlantic City, N. J., May 17-21. M. H. Aylesworth, 29 West 39th St., New York.

National Electrical Credit Association—New York, May 20-21. F. P. Vose, 1008 Marquette Bldg., Chicago.

Electric Power Club—The Homestead, Hot Springs, Va., May 24-27. S. N. Clarkson, Keith Bldg., Cleveland.

American Institute of Electrical Engineers—Regional meeting, Niagara Falls, N. Y., May 26-28; annual convention, White Sulphur Springs, W. Va., June 21-25. F. L. Hutchinson, 33 West 39th St., New York.

American Association of Engineers—Philadelphia, June 1-6. M. E. McIver, 63 East Adams St., Chicago.

Electrical Supply Jobbers' Association—The Homestead, Hot Springs, Va., June 2-4. F. Overbagh, 411 South Clinton St., Chicago.

Association of Iron and Steel Electrical Engineers—Hotel Sherman, Chicago, June 7-10. John F. Kelly, Empire Bldg., Pittsburgh, Pa.

Associated Manufacturers of Electrical Supplies — The Homestead, Hot Springs, Va., June 7-11. F. Nicholas, 30 East 42d St., New York.

North Central Division, N.E.L.A.—St. Paul Hotel, St. Paul, June 8-10. J. W. Lapham, 351 Loeb Arcade, Minneapolis.

Pacific Coast Division, N.E.L.A.—Biltmore Hotel, Los Angeles, June 8-11. S. H. Taylor, 447 Sutter St., San Francisco.

Northwest Division, N.E.L.A. — Spokane, Wash., June 14-17. L. A. Lewis, Washington Water Power Co., Spokane.

Michigan Electric Light Association—Mackinaw Island, June 24-26. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

Permits Granted for Development of the Colorado River of Texas. — The Texas State Board of Water Engineers has granted to the Syndicate Power Company of Dallas permits for the construction of six dams on the Colorado River of that state between Austin and San Saba. The Syndicate Power Company is owned by the Insull interests, which have a large investment in Texas, and particulars of the project were noted in the ELECTRICAL WORLD for April 10 (page 779). The ultimate expenditure is estimated at $20,000,000. The dams will impound 3,567,600 acre-feet of water, develop 122,700 hp. and back up water to an aggregate of 140 miles. Work is to begin within two years and the total development will, it is announced, be finished in nine years.

Work to Begin on Toccoa Dam.—Preliminary work on the 20,000-hp. power project of the Toccoa Power Company, a subsidiary of the Tennessee Electric Power Company, has been completed, it is announced, and everything is in readiness to begin work on the mile-long dam which will be thrown across the Toccoa River near Blue Ridge, Ga. The dam will be 165 ft. high and 900 ft. thick at the base, graduating to a 300-ft. thickness at the top, across which will run a section of the Atlanta-to-Asheville highway. It will be one of the largest hydro-electric dams in the Southeast and will form a lake 12 miles long and 75 ft. deep on an average. Most of the power developed will, it is announced, be transmitted across the state line into Tennessee. The development was started in 1916, but was temporarily abandoned during the war. The work has also been hampered by litigation. The ultimate cost of the project is put at $10,000,000.

Electric Heating School at Mansfield, Ohio, June 14-26. — Plans have been completed for the annual industrial electric heating school under the direction of the N.E.L.A. power committee. which will be held on June 14-26 at the Mansfield (Ohio) works of the Westinghouse Electric & Manufacturing Company. The course will enable power engineers taking it to develop the market for industrial electric heating, analyze heating applications, make surveys at minimum cost, investigate the economic phases of this class of loads and improve load factors. The cost to central-station companies sending men to take the course is the cost of living (averaging perhaps $7 per day) and the traveling expenses of their representatives for two weeks. All desiring to take the course should apply to V. M. F. Tallman, chairman power committee N.E.L.A., 200 Devonshire Street, Boston, before June 5.

Men of the Industry

B. C. Edgar New President of Southeastern Division, N.E.L.A.

B. C. Edgar, who was elected president of the Southeastern Division of the National Electric Light Association, as announced in the May 8 issue of the ELECTRICAL WORLD, is vice-president and general manager of the Tennessee Electric Power Company and president of the Nashville Railway & Light Company. During Mr. Edgar's official connection with the Tennessee company that enterprise has grown until now it is distributing power in Tennessee to more than one hundred cities and operating more than 300,000 hp. in generating plants. With Mr. Edgar as vice-president, the Tennessee

B. C. EDGAR

company has projected a program of development which will take care of the company's Tennessee territory up to 1930.

Mr. Edgar is a native of Rahway, N. J., and a graduate of Rutgers College, New Brunswick, N. J. After engaging in railway electrification in the East he went to the Pacific Coast, affiliating himself with the Southern Pacific Company. Later he spent two years as assistant general superintendent of the Columbus (Ohio) Railway, Power & Light Company, but severed his connection with that utility to become general superintendent of the Nashville Railway & Light Company. It was in 1919 that Mr. Edgar was promoted to be vice-president and general manager of the companies which later were merged to form the Tennessee Electric Power Company, he retaining his former title in the merger company. He became chief executive of the Nashville utility last December. Mr. Edgar has been prominent in the affairs of the Southeastern Division, his election to the presidency following his occupancy of the office of first vice-president.

John Watson Alvord, consulting engineer, has been selected to receive the Washington award for 1926. This award, which will be presented to Mr. Alvord at the annual meeting of the Western Society of Engineers on June 2, is made every year by a committee of representatives from the Western Society of Engineers, the A.I.E.E., the A.S.M.E., the A.S.C.E. and the A.I.M.E. It was established in 1917 to be presented annually to an engineer whose services have been noteworthy for promoting the public good.

Sidney B. Paine Retires

Sidney B. Paine, manager of the textile division of the industrial department of the General Electric Company, with headquarters for many years at Boston, resigned May 1. Mr. Paine is one of the best known engineers in the world in the field of textile power application and carried out the pioneer cotton-mill electrification at the Columbia Mills, Columbia, S. C., in 1894, an installation which is still in operation. He was born in Fall River, Mass., in 1856, was graduated from the Brooklyn Polytechnic Institute in 1875, began electrical work in 1881 in New York under Dr. Paget Higgs, and for several years was associated with Spencer Borden in selling the Edison system for isolated lighting in New England. Upon the organization of the Edison General Electric Company he was made manager for New England, and when the General Electric Company was organized in 1892 he was detailed to investigate the electrical operation of textile mills and later made manager of the mill power department, covering all districts. Mr. Paine is a member of the Edison Pioneers and of the A.S.M.E. and is a former fellow of the A.I.E.E. His long and distinguished career has had a profound influence upon the upbuilding of close relations between the textile and electrical industries, and as far back as 1895 a medal was awarded to him by the New England (now National) Association of Cotton Manufacturers for originating and developing motor applications in textile mills.

Edouard Roth of the Société Alsacienne de Constructions Mécaniques of Belfort has been made the recipient of the Herbert prize for his work on alternators and synchronous motors.

Samuel Insull, president of the Commonwealth Edison Company, Chicago, arrived from Europe aboard the liner *Majestic* April 11 after a short stay abroad.

Sir Glyn West, president of the Newfoundland Power & Paper Company, and **John Stadler,** general manager, have resigned and will be succeeded by **E. Bernard Smith,** who will perform the duties of both offices. **Andrew Whyte** has been appointed vice-president to succeed H. D. Reid, who resigned some time ago.

P. E. Chapman, formerly superintendent of underground distribution for the Pacific Gas & Electric Company in the San Francisco district, has been made assistant electrical engineer for the company in the same division. **R. P. Lutzi,** who has been assistant superintendent, succeeds Mr. Chapman as superintendent, and **H. K. Woodward** has been appointed to Mr. Lutzi's former position. All of these men have records of many years' service with the Pacific Gas & Electric Company.

F. A. Stratton Elected Chairman of Westchester Utility

Francis A. Stratton, president of the Westchester Lighting Company, Mount Vernon, N. Y., has been elected chairman of the board of directors, and E. H. Rosenquest, president of the Bronx Gas & Electric Company, has been elected president of the Westchester utility to succeed him. Mr. Stratton was largely instrumental in combining the gas and electric lighting plants of a large part of Westchester County into one corporation, and when the Westchester Lighting Company was

F. A. STRATTON

organized in 1900 he became its vice-president and general manager. In 1909 he was elected to the presidency, and during his occupancy of that office he devoted himself unselfishly to the interests of the company and the communities it serves, giving special attention to the establishment of cordial relations between the utility and its customers. His election as chairman of the board will relieve him of much corporation detail and will give him time to attend to more important matters and to continue his interest in municipal and county affairs generally. Though a native of Little Valley, N. Y., Mr. Stratton lived for many years in Tennessee, engaging in the lumber business, the real estate business and later establishing a state bank in Johnson City, where he also built an electric light plant, of which he was the principal owner and managing director. At the present time he is president and a director of the Peekskill Lighting & Railroad Company, the Northern Westchester Lighting Company and the Quaker Ridge Improvement Company and a director in various other corporations. Personally Mr. Stratton enjoys the regard and esteem of his fellow townsmen to a remarkable degree.

Eugene H. Rosenquest, the new president, has been identified with utility affairs for thirty years or more. He is a past-president of the Empire State Gas & Electric Association and a member of the American Institute of

Electrical Engineers, the Illuminating Engineering Society and other organizations.

I. E. Moultrop Heads Boston Edison Engineers

Irving E. Moultrop has been appointed chief engineer of the Edison Electric Illuminating Company of Boston, effective as of May 1. Mr. Moultrop is one of the best-known generating-plant designers and builders in the public utility industry. For many years he has been assistant superintendent of the construction bureau of the Boston company in immediate charge of the program of station development which lately reached its most advanced stage in the opening of the new Edgar station at Weymouth. This pioneer 1,200-lb. installation is now producing energy at a fraction below 1 lb. of coal per kilowatt-hour, and Mr. Moultrop's work

I. E. MOULTROP

in connection with this development has added much to his already notable reputation.

Mr. Moultrop was born at Melrose, Mass., and served an apprenticeship in the Whittier Machine Company's shop at Roxbury, subsequently becoming chief draftsman. It was in 1892 that he entered the employ of the Boston Edison Company as chief draftsman, and in 1897 he was appointed mechanical engineer. Since 1913 he has served as assistant superintendent of the construction bureau. Mr. Moultrop has been an indefatigable worker on various committees of the representative engineering associations, including the National Electric Light Association, the American Institute of Electrical Engineers, the Association of Edison Illuminating Companies and the American Society of Mechanical Engineers, being also a former vice-president of the last-named association.

C. G. **Durfee**, formerly connected with the sales department of the Westinghouse Electric & Manufacturing Company, has joined the staff of the Society for Electrical Development, New York.

Theodore Settle of the General Electric Company, Ltd., London, England, has been making a tour of this country with the purpose of studying American practices in domestic cooking. His itinerary has included Chicago, Minneapolis, Spokane, Portland, San Francisco and other places. Mr. Settle will report the results of his observations upon his return to England.

T. S. Louttit, attorney of Stockton, Cal., has been appointed by Governor Richardson as a member of the California Railroad Commission to fill the unexpired term of the late George D. Squires.

Owen D. Young, chairman of the board of directors of the General Electric Company and of the Radio Corporation of America, arrived from Europe May 5 aboard the White Star liner *Olympic* after an absence of two months. Mr. Young spent most of his time in conference with the international consortium which controls South American radio communication.

Obituary

Frank J. Pryor, secretary-treasurer of the American Electric Power Company, Philadelphia, died April 11 in his fifty-ninth year. Mr. Pryor was born in Pottsville, Pa., and was graduated from the University of Pennsylvania. He became identified with the American Electric Power Company about 30 years ago.

Andrew Charles Loudon, vice-president of the Superheater Company, Ltd., Montreal, died at his residence in Burlington, Vt., April 11 after a few days illness. Mr. Loudon affiliated himself with the Superheater Company of New York in 1917 in the engineering and service departments. Three years later he took charge of the Superheater Company, Ltd., becoming vice-president in 1921. Mr. Loudon was a member of the American Society of Mechanical Engineers, the Engineering Institute of Canada and the Engineers' Club of Montreal.

Henry F. Albright, vice-president in charge of manufacturing and a director of the Western Electric Company, died in New York May 11 after an illness of several months. Mr. Albright entered the employ of the Western Electric Company in 1892 as a salesman of electric light and power apparatus in Chicago. Two years later he was transferred to the construction department in the New York office and in 1897 was made plant engineer of the New York factory. He was promoted in 1899 to be general manager of the New York shops. His appointment as general superintendent of the Western Electric manufacturing plants followed eight years later, and Mr. Albright moved to Chicago subsequently to direct the Hawthorne works. It was in 1917 that he was elected a vice-president and two years later a member of the board. At the time of his death Mr. Albright was head of all the company's manufacturing and plant engineering activities.

James W. Thomas, engineer, died at his home in Plandome, L. I., April 13 in his fifty-second year. Mr. Thomas was born in Boston and was graduated from the Massachusetts Institute of Technology in 1895. His varied business career included connections with Westinghouse, Church, Kerr & Company, the New England Engineering Company and subsequently the United Gas & Electric Company of Connecticut, where for many years he handled a great variety of work for the firm's various properties. Mr. Thomas was a fellow of the American Institute of Electrical Engineers and a member of the American Society of Mechanical Engineers and of other technical associations.

Gordon O. Philp, who had been superintendent of the Hydro-Electric Power Commission of Ontario since 1919, died Dec. 24, 1925, at Niagara Falls of blood poisoning. After graduation from the University of Toronto Mr. Philp entered the engineering department of the Electric Power Company, and when this company was taken over by the Ontario government in 1916 he joined the operating staff of the Hydro-Electric Power Company. When the commission acquired control of the Ontario Power Company, Mr. Philp was chosen for the position of general superintendent. During the past few years he had assumed additional responsibilities, and at the time of his death he was general superintendent of all operations and maintenance of the commission's three properties—the Queenston Development Company, the Ontario Power Company and the Toronto Power Company.

R. Sanford Riley, president of the Riley Stoker Corporation, Worcester, Mass., and one of the most distinguished combustion engineers in the profession, died at his home in Worcester, May 7. Mr. Riley was born in Hamilton, Ontario, 51 years ago and was graduated with honors from the Worcester Polytechnic Institute in 1896. His early career included service as a draftsman with William Cramp & Sons, Philadelphia, and for a time he was employed by the Baldwin Locomotive Works, the Northern Pacific Railway, and as an instructor in mechanical engineering at the Worcester institute. In 1899 he enlisted as a marine engineer in the United States Navy, and he saw service in Asiatic waters and elsewhere for several years. From 1906 to 1908 he was assistant to the chief engineer New York Shipbuilding Company, and he was president of the American Ship Windlass Company, Providence, from 1906 to 1911. His most notable work was the development of the Taylor stoker and the invention and development of the Riley stoker, and in 1912 he organized the Riley Stoker Company, which later purchased the Murphy Iron Works, Underfeed Stoker Company of America, A. W. Cash Company and United Machine & Manufacturing Company. There are also two foreign corporations which Mr. Riley headed, the Riley Engineering & Supply Company, Ltd., of Toronto and the Riley Stoker Company, Ltd., of London, England. Mr. Riley held a first-class engineer's license without tonnage limitation and during the war served as field officer of the Emergency Fleet Corporation, in which he organized the performance department and was in charge of all trial trips. He was formerly president of the Stoker Manufacturers' Association and was a member of many engineering societies and civic organizations.

Recent Court Decisions

Statute Requiring Claim Against City to Be Filed 30 Days Before Suit Does Not Apply to Municipal Enterprises of Commercial Nature.—Cook vs. City of Beatrice was a suit for damages because of the death of a boy from contact with a guy wire belonging to the municipal system, the guy wire having become charged with electricity. The Supreme Court of Nebraska reversed a verdict for the defendant directed by the lower court on the ground that 30 days' notice of the claim should, by law, have been given to the city before suit was begun. The Supreme Court pointed out that this provision of law applied only to the city in its corporate and governmental capacity and that when it entered into a commercial enterprise like the generation and supply of electrical energy it was subject to the same rules as other commercial undertakings and could claim no privilege or exemption on account of its public status. (207 N. W. 518.)*

County Cannot Enjoin Nor State Highway Commission Grant Right-of-Way Over State Highway for Transmission Line.—The Supreme Court of North Dakota has held, in Morton County vs. Hughes Electric Company, that a board of county commissioners in that state has no power to control or supervise or grant right-of-way to a public service corporation over or upon a state highway within the county and that it cannot enjoin the construction of such a line. It does not follow, however, the court said, that the state highway commission can grant such a right-of-way, that body having only the powers conferred upon it by law. This case concerned a line which the Hughes Electric Company desired to carry over a Missouri River bridge to connect Bismarck and Mandan and which the county sought to enjoin. Denying emphatically the county's right to do this, the court refrained from determining where judicial relief, if any was available to the county authorities, lay. (208 N. W. 108.)

Preponderance of Evidence Required to Show Injury Caused by Employer's Negligence.—Cooper vs. Fort Smith Light & Traction Company was a suit for damages because of the death of a foreman employed by the company who while working on a pole received a shock that caused him to fall to the ground, fatal injuries resulting. The plaintiff claimed that the shock was due to current escaping from high-tension wires to a brace with which the workman came into contact. The defendant's theory was that the victim came into contact with two wires, his body forming the path for a short circuit. If the first theory was right, the Supreme Court of Arkansas held, the company would be liable; if the second theory was the correct one, it would not. Finding that the evidence showed the high-tension wires to be properly installed and maintained, the court reversed a verdict for the plaintiff, saying no recovery could be had unless the preponderance of evidence showed injury to have been inflicted through the employer's negligence. It was not necessary to consider the company's further defense—that the man had failed to use the safety belt and rubber covering for the wires provided for him. (280 S. W. 990.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Characteristics of Pre-Regulatory Period as They Affect "Going Value."—The Michigan Public Utilities Commission, in establishing rates for the Monroe Gas, Light & Fuel Company, allowed only $6,000 for "going value," although the company claimed $65,000. The United States District Court in Michigan granted the company, in a suit brought by the latter against the commission, a higher rate based on reproduction cost less depreciation. On the point of "going value" the court said: "We venture to think that much confusion as to the status of 'going value' has arisen through failure to distinguish the characteristics of the pre-regulatory period. Of course, the moment a commission has fixed the annual cost of getting business and allowed it as an operating expense, and thereby *pro tanto* increased the rate to which the company would otherwise have been restricted, that moment this cost, to that extent, ceases to be capitalizable or to have any effect on the rate base. Not so in the earlier period, when there was a franchise contract rate, expressed or implied. There never was any obligation, without contract or statute, on a public utility of this kind to render service for a rate just barely above the confiscation line. In its discretion the Legislature might so order, but otherwise the courts would not compel it. The limit of the common-law power, if there is such power, would be to prevent an extortionate charge. Between that unreasonably low rate which a statute may not compel and the unreasonably high one which (perhaps) the common law would not permit, there is a wide margin of fair rates, and in the pre-regulatory period this margin belonged by contract to the utility to use for dividends or to retain added to the investment for improvements and development, as it pleased; in either case it was increasing fair value, as affecting a future rate base. If the service given, plus a fair return, was worth more than the contract rate, the public gained and the utility was remediless — if less, the entire gain, whether much or little, belonged to the utility. The same reasons apply to the regulatory period as to development costs paid out of the allowed return, instead of using it for dividends or tangible new assets. For the reason stated, we must reject the estimate of $65,000. Reported decisions show estimates as high as 25 per cent or 30 per cent of the cost of tangibles. These may be extravagant. Seemingly there is no definite percentage relation. At the same time the proposition that a plant of this kind in this business and in successful operation, with customers somewhat permanently attached for its capacity output, is worth 10 per cent more than the skeleton would cost seems not unreasonable — no circumstances *contra* appearing. Further, it is obvious that in making a rate for a contemplated period of, say, three years, there should be added to the rate base a suitable estimate for the reasonably certain additions to the plant during the period and which cannot be made without new capital or an equivalent retention of dividends."

Commission Rulings

Issue of Common Stock for Control Purposes Disapproved.—In disapproving an application from the Public Utilities Storage Company for permission to issue common stock to the Oakland Terminal & Elevator Company in payment for services alleged to have been rendered by the latter, the California Railroad Commission said: "It seems that the main purpose of the agreement between the two companies is to assure to the Oakland Terminal & Elevator Corporation through stock ownership the control of applicant corporation. In effect the commission is asked to authorize the issue of common stock for control purposes. Such a request has never been, nor will it in this instance, be granted. On the basis of the record in this proceeding, applicant should be able to sell both its common and preferred stock at par for cash. If the Oakland Terminal & Elevator Corporation desires to control applicant through stock ownership, it should pay cash for such of applicant's stock as it may desire to purchase."

Sale of Stock Below Market Value Authorized.—The Pacific Gas & Electric Company was authorized by the California Railroad Commission to sell common stock to its stockholders at par, although the market value is greater. The commission said: "It is not an established fact that applicant must sell its common stock at par in order to readjust its proportions of bonds and stock as desired. As a matter of fact, the common-stock equity might be built up faster were applicant to take advantage of the present market value (about $130 per share) of its stock and sell the stock at a premium. Less stock would have to be issued, if sold at a premium, to raise a certain amount of money than if stock were sold at par to raise the same amount. It is urged, however, that the sale of stock at a premium would affect the present market value adversely. What this effect would be is a matter of conjecture. Offsetting this element of uncertainty, we have the testimony of applicant's witnesses that its proposal to offer the common stock at par to its stockholders will enable it to sell the stock with little or no expense and reduce market value fluctuations of such stock, except as affected by a panic or world war, to a minimum. They urged that the application be considered from the standpoint of future financing as well as from that of meeting immediate needs.

Financial and Corporate

Utility Stocks Firm

Price Changes Small in Quiet Trading as Money Position Continues to Be Favorable

ON THE announcement of the general strike in Great Britain the market for stocks of all descriptions turned more quiet than it had been at any time since the early autumn of 1924. News of the strike developments had no appreciable influence upon the price trend, which changed little during the week in either direction. The position of money remained favorable to increased speculative activity in stocks, but evidences of a slight recession in industry have made traders exceedingly cautious. While different sections of the country show different degrees of gain or loss, the power and light output curves have not shown the same persistency in advancing that had been noted before. At the moment that is not bringing any recession in the price for utility stocks, but it has taken away some excessive speculation in the issues.

Power and light bonds and the better-grade preferred stocks continue to hold their position of favor in the investment field, and houses report an inability to meet all demands for good issues made upon them. The outstanding improvement for the week among the common stocks was an advance of 40 points in Columbus Electric & Power, although an advance of five points in American Light & Traction was recorded. Puget Sound Power & Light dropped to a position two points lower than where it stood the week before, and losses of a point or more were made by such issues as Electric Investors, Inc., Middle West Utilities, Southeastern Power & Light and United Gas Improvement.

In the list of preferred power and light stocks numerous issues improved their position by one to three points during the week.

Why General Electric Has Split Its Stock

Earnings Plowed Back Into Plant Have Put Company's Securities in Strong Position

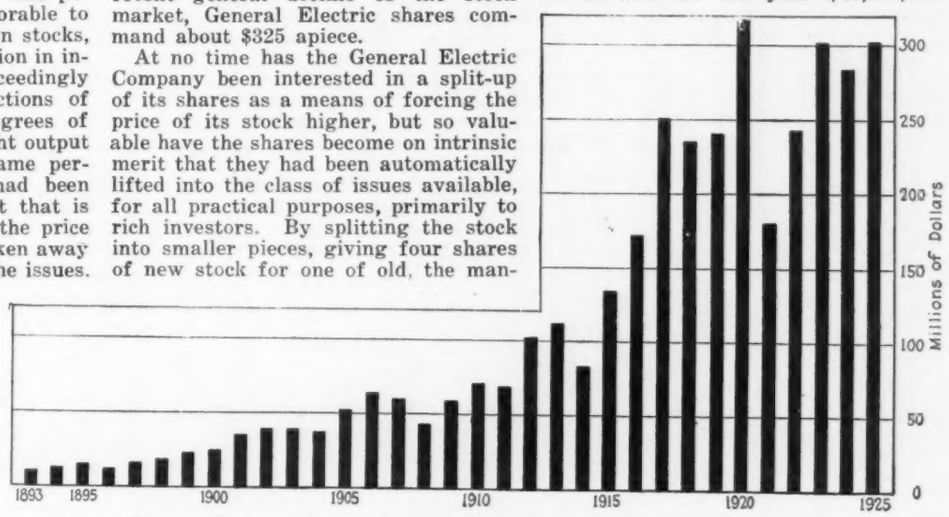
BY PAUL WILLARD GARRETT
Financial Editor *New York Evening Post*

TO ANY one who has followed the growth of the General Electric Company over a period of years the reason why that organization determined to divide its common stock into smaller units is not difficult to find. Since the creation of the company in 1892 the management has made it a policy always to build for the future by plowing a certain proportion of earnings back into plant, with the result that the company has become one of the best-earning properties of the country. For a quarter of a century General Electric has been earning at the average rate of $16.73 a share on its common stock annually; the average rate during the last four years has been $18.75 a share, and in 1925 it earned $20.49. With earnings so large the price of the common shares naturally would be raised to a relatively high price in the open market, and even today, despite the loss suffered in the recent general decline of the stock market, General Electric shares command about $325 apiece.

At no time has the General Electric Company been interested in a split-up of its shares as a means of forcing the price of its stock higher, but so valuable have the shares become on intrinsic merit that they had been automatically lifted into the class of issues available, for all practical purposes, primarily to rich investors. By splitting the stock into smaller pieces, giving four shares of new stock for one of old, the management will enable small investors as well as large to buy freely of the issue. It is interesting that in making the change the General Electric has favored the no-par-value stock over the par-value stock. It is changing the present authorized issue of 1,850,000 shares of $100 par-value stock into 7,400,000 shares without par value.

The plan is to pay on July 15, 1926, a quarterly dividend on the new common stock without par value of 75 cents a share in cash and an annual dividend of $1 a share in special 6 per cent stock of the company.

Net sales billed in 1925 fell slightly behind those for 1924, but the annual report recently published shows that orders received during 1925 of $302,513,380 were 7 per cent greater than the $283,107,697 received during the earlier year. Net income from sales in 1925 was $32,810,675 and from other sources $10,360,067, making the total net income for the year $43,170,743. Since the company has only $2,047,000 in funded debt, and since the 6 per cent cash dividends on the special stock last year equaled only $1,735,576, the greater part of the net income, $36,905,641, was available for the common stock. Cash dividends on the common stock took $14,407,544, so that the surplus in excess of dividend requirements was $22,498,097.



ORDERS RECEIVED ANNUALLY BY GENERAL ELECTRIC COMPANY SINCE 1893

Company Reports

Name of Company	Gross Earnings for March 1926	Gross Earnings for March 1925
Bangor Hydro-Electric	$148,448	$136,286
Baton Rouge Electric	75,903	60,225
Binghamton Lt., Ht., & Pwr.	154,566	132,389
Blackstone Valley Gas & Electric and subsidiaries	472,681	403,532
Brazilian Traction, Lt. & Pwr.	3,077,791	2,344,123
Cape Breton Electric	48,007	48,229
Central Illinois Light	354,848	333,455
Central Maine Power System	408,295	399,660
Cities Service	2,165,641	1,922,141
Columbia Gas & Electric	3,500,339	2,504,619
Columbus Electric & Power	285,170	217,798
Commonwealth Power	4,024,755	3,566,590
Consumers Power	1,937,589	1,656,223
Edison Elec. Illg. (Brockton)	159,978	142,735
Electric Lt. & Pwr. of Abington & Rockland	45,693	38,247
El Paso Electric & subs	223,045	204,331
Electric Power & Light	4,010,671	3,635,809
Florida Public Service	152,898	83,097
Georgia Railway & Power	1,413,953	1,546,527
Houghton County Electric Light	43,328	41,620
Idaho Power	202,397	192,927
Illinois Power	235,165	222,064
Kansas City Power & Light	905,723	849,166
Key West Electric	24,782	21,801
Lowell Electric Light	$142,880	$136,662
Metropolitan Edison	820,120	693,153
New Jersey Power & Light	179,289	95,244
North Carolina Public Service	158,611	149,505
Northern Ohio Power	1,026,378	941,924
Northern Texas Electric & subs.	227,844	224,935
Ohio Edison	155,846	132,092
Philadelphia Co. and affil. corp.	6,268,482	5,667,532
Portland Electric Power	984,612	943,847
Puget Sound Power & Light and subs	1,095,013	1,045,562
Republic Railway & Light	1,020,868	949,170
Savannah Electric & Power	181,186	156,198
Sayre Electric	24,320	22,889
Sierra Pacific Electric & subs.	98,717	89,018
Southern California Edison	1,956,392	1,821,961
Southern Canada Power	116,968	95,884
Southern Indiana Gas & Electric	245,085	219,384
Southwestern Power & Light	1,167,142	1,040,339
Tennessee Electric Power	970,403	907,561
Texas Power & Light*	631,568	593,674
Utah Power & Light*	853,251	800,725
Washington Water Power	470,962	429,644
Winnipeg Electric	481,795	473,687
York Utilities	21,320	17,481

* February.

New Capital Issues

The Indianapolis Power & Light Corporation made an offering during the past week of first collateral trust gold bonds, series A, totaling $10,000,000, the price being 98 and accrued interest, to yield over 6.25 per cent.

The General Public Utilities Company offered first mortgage and collateral trust gold bonds to the amount of $6,300,000. These bonds were priced at 98 and accrued interest, to yield 6.65 per cent.

The Penn.-Ohio Edison Company issued 7 per cent cumulative prior preference stock at 96 and accrued dividends, to yield about 7.30 per cent, a piece of financing involving a total of $1,500,000.

The Montana-Dakota Power Company offered first mortgage 5½ per cent gold bonds amounting to $1,500,000. the price being 99.75 and accrued interest to yield about 5.60.

First and refunding mortgage 5 per cent gold bonds of the Mississippi Power Company to the amount of $1,750,000 where offered at 95 and interest, to yield over 5.33 per cent.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday May 8	Low 1926	High 1926
STOCKS			
ABITIBI PWR. & PAPER, com. —no par	k 73	71¼	84¼
Adirondack Pwr. & Lt.—7% pf.	k101½	....	....
Adirondack Pwr. & Lt.—8% pf.	109	108	110
Ala. Pwr., pf.	k105	....	....
Allis-Chalmers Mfg. pf.	k109	105	110
Allis-Chalmers Mfg., com.	k 80½	78¼	94½
Aluminum Co. of Amer., com.	k 63	54¼	76
Aluminum Co. of Amer. new, pf.	k 93	....	....
Amer. & Foreign Pwr., pf. 25% pd.	m108	108	131
Amer. & Foreign Pwr., 7% pf.—no par	90½	89	98
Amer. & Foreign Pwr., com.—no par	k 17	17	42½
Amer. Bosch Magneto, com—no par	m 19½	19¼	34½
Amer. Brown Boveri, Elec.	k 35	30¼	48½
Amer. Brown Boveri Elec. pf.	k 96	86½	97½
Amer. Elec. pwr., pf.	m111½	102½	111½
Amer. Gas & Elec., 6% pf.—no par.	k 90½	....	....
Amer. Gas & Elec., com.—no par.	k 74	64	99½
Amer. Lt. & Trac., 6% pf.	107	114½	115½
Amer. Lt. & Trac., com.	k205	195	263
Amer. Pwr. & Lt., 6% pf.	k 93	....	....
Amer. Pwr. & Lt., com.—no par	k 52½	48¼	79½
Amer. Pub. Serv., 7% pf.	k 94	....	....
Amer. Pub. Serv., com.	47	45	80
Amer. Pub. Utilities, 6% pf.	82	85	86
Amer. Pub. Utilities, 7% pf.	k 90	89	89
Amer. Pub. Utilities, com.	70	80	82
Amer. States Sec., A	k 2½	....	....
Amer. States Sec. B	1½	1¼	5½
Amer. Superpwr., pf.—25	24½	23	26¾
Amer. Superpower, pf.	91	90	94
Amer. Superpwr., Class A—no par.	22½	19½	37½
Amer. Superpwr., Class B—no par.	k 24½	21½	39
Amer. Wtr. Wks. & Elec., 7% pf.	103	101¼	108½
Amer. Wtr. Wks. & Elec., com.—20.	k 49½	43¼	74
Anaconda Copper	k 45½	41¼	51
Appalachian Pwr., 7% pf.	100	99	101
Appalachian Pwr., 1st pf., 7%	100	99	101
Appalachian Pwr., com.	80	80	83
Arizona Pwr., 7% pf.	k 75	....	....
Arizona Pwr., com.	m 27	27	35½
Arkansas Cent. Pwr., pf., $7—no par	101	99	102
Arkansas Lt. & Pwr., 7% pf.	96	96	102
Arkansas Lt. & Pwr., com.	100	110	115
Asheville Pwr. & Lt., 7% pf.	l104	100½	104
Assoc. G.&E., pf.—$3 50—50	k 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	k 83	....	....
Assoc. Gas & Elec., Class A—no par	k 29½	25½	35½
BABCOCK & WILCOX, com.	k113	....	....
Binghamton Lt., Ht. & Pwr., pf.	105	....	....
Birmingham Elec. pf.—$7—no par.	102	101	103½
Blackstone Valley Gas & Elec., pf.	92	90	106
Blackstone Valley G.&E., com.—50.	92	....	....
Blaw-Knox, com.	f 50	45	56
Brazilian Trac., Lt. & Pwr., com.	f 91½	....	....
Broad River Pwr., pf.	k 93	....	....
Brooklyn Edison, com.	k139	133	146½
Buffalo, Niagara & East. Pwr., pf.—25	k 24½	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par	k 26½	....	....
CALIFORNIA ELEC. GENERATING, pf.	90	89	93
California Ry. & Pwr., pf.	105	88	115
Carolina Pwr. & Lt., pf.—$7—no par	103	102	107
Cent. & S. W. Ut. 7% pf.—no par	a 92	89½	95
Cent. & S. W. Ut., pr. ln. pf.—no par	a 96	95	100
Central Ariz. Lt. & Pwr. pf.	102	....	....
Central Ark. Ry. & Lt., 7% pf.	k 98	....	....
Central Ill. Pub. Serv., 6% pf.	88	89	91
Central Ind. Pwr., 7% pf.	88	88	93½
Central Pwr. & Lt., pf.	94	94	98½
Central States Elec., 7% pf.	k 93	....	....
Central States Elec., com.	m200	200	230
Century Elec., com.	b116	110	116
Chicago Fuse Mfg., com., no par.	a 32	30½	35
Cincinnati Gas & Elec., com.	g 89½	88	95½
Cities Service, 6% pf.	k 82½	....	....
Cities Service, pf. B—10.	k 7	....	....
Cities Service, pf. BB—100.	k 74	....	....
Cities Service, com.—20.	k 41	....	....
Cities Service, Bks. Shrs.—10.	k 19½	....	....
Clarion River Pwr., pf.	93	93	95
Cleveland Elec. Illg., 6% pf.	105½	103	105½
Cleveland Elec., Illg., com.	k225	....	....
Colorado Pwr., 7% pf.	k 96	....	....
Columbia Gas & Elec., 7% pf.	k112½	112	115
Columbia Gas & E., com.—no par.	k 76	63½	90
Columbia Ry., Gas & Elec., 6% pf.	95	95	96
Columbus Elec. & Pwr., 2d pf.	k103	....	....
Columbus Elec. & Pwr., com.	k255	....	....
Columbus Ry., Pwr. & Lt., 1st. pf.	97	98	99
Columbus Ry., Pwr. & Lt., pf. B.	95	92	95
Col. Ry., Pwr. & Lt., com.—no par.	82	82	85
Commonwealth Edison, com.	a139½	137½	144
Commonwealth Pwr., 6% pf.	k 84½	....	....
Commonwealth Pwr., com—no par.	k 34	28½	42½
Conn. Lt. & Pwr., 8% pf.	116	117	121
Conn. Lt. & Pwr., 7% pf.	108	108	113
Cons. Gas of N. Y., pf.—50.	k 57½	....	....
Cons. Gas of N.Y., com.—no par.	k 92½	87	104½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	e104	102	105
Cons. Gas. Elec. Lt. & Pwr. of Balti 6½% pf.	e110½	108½	110½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	e112½	109	115½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	e126½	124	128½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	e 50	45	57½
Cons. Pwr. & Lt., 7% pf.	104	100	107
Consumers Pwr., 6% pf.	97	95	98
Consumers Pwr., 6.6% pf.	102	101½	103½
Continental Gas & Elec., 7% ptc. pf	k 97½	....	....
Continental Gas & Elec., 7% pr. pf.	k 94½	....	....
Continental G.&E., com.—no par.	100	85	150
Crocker Wheeler, com.	14	14	19
Crocker Wheeler, pf.	50	50	55
DALLAS PWR. & LT., 7% pf.	102	102	104
Dayton Pwr. & Lt., 6% pf.	98½	95	97
Detroit Edison, com.	k130½	123½	141½
Dubilier Condenser & Radio, com. no par.	k 6½	4½	11
Dubuque Elec., 6% pf.	97	93	97
Duquesne Lt., 7% pf.	k114½	111½	116½
EAST. N. Y. UTIL. pf.	80	80	85
Eastern New York Util., com.	65	70	75
Eastern States Power.	14	23	32½
Eastern States Pwr., pf.	k 87	....	....
Eastern Tex. Elec., 7% pf.	k103	....	....
East. Tex. Elec., com.—no par.	75	103	107
Edison Elec. Illum. of Boston, com.	d217	207	250
E. Paso Elec., com.—no par	70	70	94
E. Paso Elec. pf.	101	102	104
Elec. Bond & Share, 6% pf.	l106½	103½	107½
E. Bd. & Share Sec., com.—no par.	l 66	56½	86
El. Household Util.	a 16½	16	25
Elec. Investors, 6% pf.—no par.	89	92	95
Elec. Investors, com.—no par.	35	30½	74½
Elec. Investors, 10% pd. receipts.	18	....	....
Elec. Pwr. & Lt., ctfs., pf.	k101	89½	97½
Elec. Pwr. & Lt., ctfs., 40% pd.	k101	99½	115
Elec. Pwr. & Lt., ctfs. full pd.	103	103	110½
Elec. Pwr. & Lt., ctfs., com.—no par	k 19	17¾	34½
Elec. Ry. Securities, com.—no par.	m6	4¼	10
Elec. Refrig.	k 65	63	67
Elec. Storage Battery, com.—no par.	k 76½	71½	79½
Elmira Wtr., Lt. & R. R., 7% pf.	98	97½	99½
Emerson Elec. pf.	b103	100	104½
Empire Dist. Elec., 6% pf.	80	80	85
Empire Pwr., A.	k 20½	....	....
Eng. Pub. Serv., pf.—no par.	97½	99½	104½
Engr. Pub. Serv., com.—no par.	k 22½	21	29½
Eureka Vac. Cleaner, com.—no par.	k 47½	45	53½
FAIRBANKS MORSE, com—no par	48½	46	59½
Fairbanks Morse, pf.	115	108½	115
Federal Lt. & Trac., com.	k 29	28	39½
Federal Light & Traction, pf.	87	87	89
Federal Utilities, pf.	k 70	....	....
Federal Utilities, com.	k 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	l105	105	108
GALVESTON-HOUSTON ELEC., 6% pf.	k 40	....	....
Galveston-Hstn El., com.	k 12	....	....
Gen. Elec., w. i.	k 79	77½	83½
Gen. Elec., com.	k313½	285	386½
Gen. Elec., special—10.	k 11½	11	11½
Gen. G.&E., (Del.) com. A no par.	38	34	59
Gen. G.&E., (Del.) com. B no par.	k 27	....	....
Gen. G.&E., (Del.) A pf. $8—no par	107	105½	110½
Gen. G.&E., (Del.) A pf. $7—no par	96½	95½	99½
Gen. G.&E., (Del.) B pf.	m 94	92½	96
General Public Service, pf.	m101	100	106½
General Public Service, com.	m 12½	12¾	16½
Ga. Lt., Pwr & Rys., 6% pf.	82	82	85
Ga. Lt., Pwr. & Rys., com.	m 57½	56½	73½
Ga. Ry. & Pwr., 8% pf.	110	112	114
Ga. Ry. & Pwr., 7% pf.	101	101½	103
Ga. Ry. & Pwr., 4% pf.	m133	....	....
Ga. Ry. & Pwr., com.	k115	....	....
Gt. Western Pwr., 7% pf.	k100½	....	....
HAVANA ELEC. UTIL., com.	m 38½	37½	44½
Havana Elec. Util., pf.	69	64½	71½
IDAHO PWR., 7% pf.	102	103	104
Ill. No. Utilities, 6% pf.	90	88	92
Ill. Pwr. & Lt., 7% pf.	k 97½	....	....
Ingersoll Rand.	91	80½	104
Int. Combus. Engr., com.—no par.	k 44½	33½	64½
Int. Utilities, class A—no par.	k 32	....	....
Int. Utilities, class B—no par.	k 5	4½	9½
Interstate Pwr., pf., $7 no par.	k 93	....	....
Interstate Pub. Serv., 7% pf.	96	96½	97
Iowa Ry. & Lt., 7% pf.	95	98	100
JERSEY CENTRAL PWR. & LT. 7% pf.	94	95	97½
Jersey Central Pwr. & Lt., ptc. pf.	95½	95½	96½
Jersey Central Pwr. & Lt., com.—no par	45	45	50
Johns-Manville, com.—no par.	k138	130	159
KANSAS CITY PWR. & LT., pf.	k109½	107½	110½
Kansas Gas & Elec., 7% pf.	l100½	99	102
Kentucky Hydro-Elec., pf.	a 93½	91½	95
Kentucky Sec., 6% pf.	75	75	77
Kentucky Sec., com.	100	90	100
Kentucky Utilities, 6% pf.	90	90	95
Keystone Pwr. & Lt. 7% pf.	95	95	97
Kings County Ltg., 7% pf.	101	101	106
Kings County Ltg., 8% pf.	103	105	108
LACLEDE GAS LT., com.	155	146	168
Lehigh Pwr. Sec., com.—no par.	k 13	10	23
Long Island Ltg., 7% pf.	104	105	107
Long Island Ltg., com.—no par.	110	120	150
Los Angeles Gas & Elec., 6% pf.	k 96	....	....
Louisville Gas & Elec., Class. A.	k 24½	22½	26½
MANHATTAN ELEC. SUPPLY.	k 69½	56	76½
Manila Elec., com.—no par.	32	27½	35
Maytag Mfg., com.	21	19	23½
Memphis Pwr. & Lt., pf., $7, no par	102	103	105
Metro. Edison, pf.—$6—no par.	k 92	....	....
Metropolitan Edison, pf., $7, no par.	102½	102	106
Metropolitan Edison, com., no par.	45	45	50
Middle West Utilities, 7% pf.	a104½	97½	111½
Middle West Utilities, 7% pr. lien pf.	a115	106½	123½
Middle West Utilities, com.—no par.	a110	109	134½
Midland Utilities, pr. ln. pf.	a 98½	98	100
Midland Utilities pf. A.	a 96	69	98
Milwaukee Elec. Ry. & Lt., 7% pf.	100	....	....
Milwaukee Elec. Ry. & Lt., 6% pf.	91	....	....
Minn. Pwr. & Lt., 7% pf.	l101	100	103½
Miss. Pwr. & Lt., pf.	k101	....	....
Miss. River Pwr., 6% pf.	93	94	96
Miss. River Pwr., com.	k 60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	100	101	105
Mohawk Hudson Pwr., 2nd pf.—$7—no par.	k 93	....	....
Mohawk Hudson Pwr., com.—no par	k 22½	20½	28½
Montana Pwr., pf.	m114½	112½	119½
Montana Pwr., com.	75½	69½	83½
Montreal Pwr., com.	f 223½	....	....
Mountain States Pwr., pf.	k 96	....	....
Mountain States Pwr., com.	k 20	....	....
NASSAU & SUFFOLK, LTG., pf.	93	93	95
National Carbon, pf.	m126	125	128
National Elec. Pwr., pf.	m100	93	95
National Electric Pwr-A.	a 21½	19½	26
Nat.-Lt., Ht. & Pwr., com.—no par.	24	22	25
National Lt., Ht. & Pwr., 5% pf.	72	71	73
National Pwr. & Lt., pf., $7—no par.	k 98½	96	102½
National Pwr. & Lt., com.—no par.	k 19	16½	38½
National Pub. Serv., 7% pf.	91	90	94
National Pub. Serv., ptc. pf.	95	96	97½
National Pub. Serv., A com.—no par	20½	15½	24
National Pub. Serv., B com.—no par	m 12½	10	12½
Nebraska Pwr., 7% pf.	l103½	103	105½
Nevada-Calif. Elec., com.	m 23	18½	44½
New Brunswick Pwr., pf.	25	30	40
New England Pub. Serv., pr. ln. pf.	98	98	99½
New England Pub. Serv., pf.	88	95½	97
N. J. Pwr. & Lt., 7% pf.	105	104	108
New Orleans Pub. Serv., 7% pf.	99½	100	102
N.Y.& Queens Elec.Lt.& Pwr.,5% pf	88	89	90
N. Y. Central Elec., 7% pf.	95	98	100
Newport News & Hampton Ry., Gas & Elec., com.	110	108	112
Newport News & Hampton Ry., Gas & Elec., pf.	110	109	114
Niagara Falls Pwr., 7% pf.—25.	28½	27½	28½
Niagara, Lock. & Ont. Pwr., 7% pf.	108	110	111½
Niagara, Lock. & Ont. Pwr., com.—no par.	m 60½	n 60	n 73
No. Amer., 6% pf.—50.	k 50	49	50½
No. Amer., com.—10.	k 46½	42	67
No. Amer. Edison pf.—no par.	91	93	95
No. Amer., Lt. & Pwr., pf.	90	88	90
No. American Utilities, pf., full pd.	m 94½	89	96
No. American Utilities, pf., 25% pd.	m 19	18	27
N. C. Pub. Serv., pf.—$7—no par.	k 90	....	....
Northeastern Pwr., com.	k 19½	17½	36½
No. Indiana Gas & Elec., pf. A.	m 97	98	100
No. N. Y. Utilities, 7% pf.	k102½	....	....
No. Ohio Pwr., com.—no par.	k 13½	11	26½
No. Ohio Trac. & Lt., 6% pf.	75	78	81
No. Ohio Trac. & Lt., 7% pf.	85	88	91
No. Ont. Lt. & Pwr., pf.	k 78	....	....
No. Ont. Lt. & Pwr., com.	72	45	70
No. States Pwr., 7% pf.	k101	99½	102½
No. States Pwr. com.	k100½	97	136½
No. Texas Elec., 6% pf.	k 43	....	....
No. Texas Elec., com.	k 25	....	....
OHIO BRASS, com. B—no par.	74	70	79
Ohio Brass, pf.	100	98	101
Ohio Gas & Elec., 7% pf.	90	92	95
Ohio Pwr., 6% pf.	94½	93	95
Ohio Pub. Serv., 6% pf.	90	90	93
Ohio Pub. Serv., 7% pf.	99	98½	100
Ohio River Edison, pf.	99	99½	101½
Oklahoma Gas & Elec., pf.	k 95	....	....
PACIFIC GAS & ELEC., 6% pf.	k 98½	....	....
Pacific Gas & Elec. com.	122½	118	132½
Pacific Pwr. & Lt., 7% pf.	l 99	98	101½
Parr Shoals Pwr., 6% pf.	92	....	....
Penn Central Lt. & Pwr., pf.—no par	c 72	71	91
Penn-Ohio Edison, 7% pf.	93	95½	97½
Penn-Ohio Elec., 7% pf.	95	93	96

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Tuesday, May 11. lBid, low, high, Wednesday, May 12. mLatest quotations available. n1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday May 8	Low 1926	High 1926
STOCKS—Continued			
Penn-Ohio Pwr. & Lt., 7% pf.	95	94	97
Penn-Ohio Pwr. & Lt., 8% pf.	101	100	106
Penn Pwr. & Lt.—$7—no par	*l*104½	103	106½
Penn Pub. Serv., 7% pf.	99	96	100
Penn Pub. Serv., 6% pf.	86	85	90
Penn Wtr. & Pwr., com.	*c*141	141	171
Phila. Co., 6% pf.—50.	74½	47½	50½
Phila. Co., com.—50.	*k* 73½	59½	76½
Phila. Elec., com.—25.	*c* 45½	45½	67½
Pittsburgh Utilities, pf.—10.	*k* 19½	14½	19½
Portland Elec. Pwr., 7% pf.	97	97	98
Portland Elec. Pwr., 6% pf.	75	71	75½
Portland Elec. Pwr., 6% 2d pf.	72	71	75
Portland Elec. Pwr., com.	*k* 37	....	....
Potomac Elec. Pwr., pf.	*j*107½	....	....
Pwr. Corp. of N.Y., com—no par	*m* 79	77½	90½
Pwr. Sec., pf.—no par	*k* 15	....	....
Pwr. Sec., com.—no par	*k* 15	....	....
Pub. Serv. of N. J., 7% pf.	106½	103½	108½
Pub. Serv. of N. J., 8% pf.	*k*118½	115	120
Pub. Serv. of N. J., com.—no par	*a* 79	72	92½
Pub. Serv. of No. Ill., 6% pf.	*a*101	100½	103
Public Serv. of No. Ill., 7% pf.	*a*114½	112	116½
Pub. Serv. of No. Ill., com.—no par	*a*128½	128½	137
Pub. Serv. of No. Ill., com.	*a*129	128½	131½
Pub. Serv. of Okla., 7% pf.	95	92	95
Pub. Serv. Elec. & Gas, 6% pf.	100½	97	101½
Public Service Elec. Pwr., pf.	*k*110½	106	110
Puget Sound Pwr. & Lt., 7% pf.	*k*105	....	....
Puget Sound Pwr. & Lt., 6% pf.	*k* 83½	....	....
Puget Sound Pwr. & Lt., com.	*k* 47½	45	66½
RADIO CORP. OF AM., pf.—50.	46½	44½	47½
Radio Corp. of Amer., com.—no par	*k* 45	32	46½
Republic Ry. & Lt., pf.	*k*104	....	....
Republic Ry. & Lt., com.	*k* 84	....	....
Rochester Gas & Elec., 5% pf.	*m* 95	80	98
Rochester Gas & Elec., 6% pf.	101	100	102
Rochester Gas & Elec., 7% pf.	104	105	107
SAN JOAQUIN LT. & PWR., 7% pf	97	97½	98½
St. Joseph Ry., Lt., Ht. & Pwr., pf.	65	60	65
Servel Corp., Class A	22½	15½	30½
Servel Corp., Class B—no par	*k* 44	....	....
Sierra Pacific Elec., com.	*k* 27½	23	28½
Sioux City Gas & Elec., 7% pf.	97	96	98
S. E. Pwr. & Lt., pf —$7—no par	98	97	100
Southeastern Pwr. & Lt., pfc. pf.	63	60	67½
S. E. Pwr. & Lt., com.—no par	*k* 25½	20	46½
So. Calif. Edison, 8% pf.	130	135	140
So. Calif. Edison, 7% pf.	*k*109	....	....
So. Calif. Edison, 6% pf.	*k* 97	....	....
So. Calif. Edison, com.	*k*116	115½	142
Southern Cities Utilities, 7% pf.	*k* 85	....	....
Southern Cities Utilities, com.	*k* 40	28	49
Southwestern Lt. & Pwr., A	*k* 55	....	....
Southwestern Lt. & Pwr., B	*k* 45	....	....
Southwestern Lt. & Pwr., $6 pf.	*k* 81	....	....
Southwestern Pwr. & Lt., 7% pf.	*k* 98	....	....
Springfield (Mo.) Ry. & Lt., 7% pf.	95	....	....
Standard Gas & Elec., 8% pf.	*k* 56	53½	57½
Standard Gas & Elec., 7% pf.	*k*100½	....	....
Standard Gas & Elec., com.—no par	*k* 53½	51	69
Standard Pwr. & Lt., 7% pf.	*k* 92	....	....
Staten Island Edison, pf.—$6—no par	93	93	95
Superheater, com.—no par	*k*140	....	....
Syracuse Lighting, 7% pf.	102	105	107
Syracuse Lighting, 8% pf.	118	....	....
Syracuse Lighting, com.	300	260	315
TAMPA ELEC., com.	275	270	315
Tampa Elec., com., new	*k* 62	....	....
Tenn. Elec. Pwr., 6% pf.	*k* 85	....	....
Tenn. Elec. Pwr., 7% pf.	*k* 99	....	....
Terre Haute, Ind. & East Trac., pf.	20	23	37
Terre Haute, Ind. & East. Trac., com	3	3	5
Tex. Pwr. & Lt., 7% pf.	*l*104½	102	105
Tide Water Pwr., 8% pf.	*k*101	....	....
Timken Roller Bearing, com—no par	*k* 50	44½	56½
Toledo Edison, 8% pf.	111	112	114
Toledo Edison, 7% pf.	101½	101	103
Toledo Edison, com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	89	87½	89
UNITED GAS & ELEC., 6% pf.	94	94	97
United Gas & Elec., com.—no par	*m*57	56	66
United Gas & Elec. (N.J.), 5% pf.	68	70	75
United Gas Impr.—50	*c* 96½	84½	144½
United Lt. & Pwr., pf.—$4—no par.	44	....	51
United L. & P. pf.—$6.50—no par	85	81	91
United Lt. & Pwr., com. A.—no par, new	14½	12½	28
United Lt. & Pwr. com., B—no par	60	140	165
Utah Pwr. & Lt., 7% pf.	*l*101½	99	103½
Utica Gas & Elec., 7% pf.	104	103	105
Utica Gas & Elec., com.	200	....	....
Utilities Pwr., & Lt., 7% pf.	*k* 94	....	....
Utilities Pwr. & Lt., com A	*k* 20	28½	37
Utilities Pwr. & Lt., com. B—no par.	15½	14	18
VERMONT HYDRO - ELEC., 7% pf.	94	95	96
Virginian Pwr., 7% pf.	107	102	104
Virginian Pwr., com.	68	....	....
Virginia Elec. & Pwr., 7% pf.	102	101	103½
Virginia Ry. & Pwr., com.	*m*150	150	150
WAGNER ELEC., pf.	*b* 73	70	85
Wagner Elec., com.—no par	*b* 23½	20	34½
Washington Ry. & Elec., com.	*j*180	....	....
Washington Ry. & Elec., pf.	*j* 90	....	....
Washington Wtr. Pwr., com.	123	130	134
West Mo. Pwr., 7% pf.	*k* 91	....	....
West Penn., 7% pf. temp. ctfs.	100	95½	101
West Penn, com.	*m*125	118	130
West Penn Elec., pf.	100	96½	100½
West Penn Elec., Class A	92	88½	97
West Penn Pwr., pf.	109	108	112
West Va. Lt., Ht. & Pwr., 7% pf.	95	95	98
West Va. Utilities, 7% pf.—50	43	43	45
Western Pwr., 7% pf.	*k* 95	91½	99
Western Pwr., com.—no par	*m* 86	*n* 34	*n*102
Western States Gas & Elec., 7% pf.	*k* 90	....	....
Western States Gas & Elec., com.	*k* 17	....	....
Westinghouse El. & Mfg., com—50.	*k* 68½	65½	79½
Weston Elec. Instrument, Class. A.	29½	27½	31½
Weston Elec. Instrument, com.	16	13½	19
Wheeling Elec., pf.	90	91	93½
Wis. Pwr., Lt. & Ht., 7% pf.	90	85	90
Worthington Pump, pf. A	73	73	80
Worthington Pump, pf. B	54	53	65
Worthingington Pump, com.	*k* 23½	20½	44½
YADKIN RIVER PWR., 7% pf	*l*104½	102	105
Yale & Towne, com.—25	*k* 66	60½	66½
BONDS			
ABITIBI PWR. & PAPER	6s	1940 *k*101½	....
Adir. Elec. Pwr.	5s	1962 *k*101	....
Adir. Pwr. & Lt.	6s	1950 *k*106	....
Adir. Pwr. & Lt.	5s	1930 97½	97 99
Ala. Pwr.	5s	1946 100½	99 100½
Ala. Pwr.	5s	1951 98	97 99½
Ala. Pwr.	6s	1951 104½	104½ 105½
Ala. Trac., Lt. & Pwr.	5s	1962 *m*111	112 124
Aluminum Co. of Amer.	7s	1933 106½	106½ 107½
Amer. Bosch Magneto	8s	1936 *m*103	2 ....
Amer. Gas & Elec.	5s	2007 93	92 93½
Amer. Gas & Elec.	6s	2014 *k*100	98 100
Amer. Pwr. & Lt.	6s	2016 *k* 98½	96 98½
Amer. Pub. Serv.	6s	1942 100½	98½ 100½
Amer. Wtr. Wks. & Elec.	5s	1934 *k* 97½	....
Amer. Wtr. Wks. & Elec.	6s	1975 *k* 94½	92½ 94½
Anaconda Copper	6s	1929 102½	102½ 103½
Anaconda Copper	6s	1953 *k*103½	....
Anaconda Copper	7s	1938 *k*105½	....
Appalachian Pwr.	5s	1941 *k*100	....
Appalachian Pwr.	6s	2024 94½	93½ 95
Appalachian Pwr.	7s	1936 107	105 107½
Arizona Pwr.	6s	1933 100½	99½ 101
Arizona Pwr.	6s	1947 96½	95½ 97
Ark. Central Pwr.	6s	1948 103	102 103½
Ark. Lt. & Pwr.	6s	1945 *k*103½	....
Ark. Lt. & Pwr.	6s	1954 *k*100½	....
Assoc. Gas & Elec.	6s	1965 *k* 94½	92½ 100
Assoc. Gas & Elec.	6½s	1954 *k*100½	....
BERLIN CITY ELEC.	6½s	1928 99	98 100
Berlin City Elec.	6½s	1929 98	97 98½
Binghamton Lt., Ht. & Pwr.	5s	1946 *k* 99	....
Birmingham Elec.	6s	1954 103½	102½ 104
Birmingham Ry., L. & P.	4½s	1954 92	88 92½
Broad River Power	5s	1954 90	91 92
Broad River Pwr.	6½s	1934 100½	100 102
Brooklyn Edison	5s	1949 *k*104	....
Brooklyn Edison	6s	1930 104½	103½ 106½
Buffalo Gen. Elec. 1st.	5s	1939 102	101½ 102½
Buffalo G. E., 1st & Ref.	5s	1939 101½	101½ 102½
Buffalo G. E.	5s	1956 102½	99½ 102½
Burlington Ry. & Lt.	5s	1932 96½	96 97½
Butte Elec. & Pwr.	5s	1951 *k*100½	....
CALIF. ELEC. GEN.	5s	1948 *k*100½	....
Calif. Gas & Elec.	5s	1937 101½	100½ 101½
Calumet Gas & Elec.	5½s	1960 99½	97½ 99
Canadian Lt. & Pwr.	5s	1949 57	56 64
Canton Elec.	5s	1937 100½	100 101
Carolina Pwr. & Lt.	5s	1938 101	100½ 102½
Carolina Pwr. & Lt.	5s	1956 *k* 98½	97½ 99½
Carolina Pwr. & Lt.	6s	1953 *m*104½	104½ 105½
Cedar Rap. Mfg. & Pwr.	5s	1953 100½	99½ 101½
Central Ark. Ry. & Lt.	5s	1928 99½	99 100½
Central Ga. Pwr.	5s	1938 96½	95 96½
Central Ill. Lt.	5s	1943 *k*100½	....
Central Ill. Pub. Serv.	5s	1952 93½	92 93½
Central Ill. Pub. Serv.	5½s	1950 97½	96 97½
Central Ill. Pub. Serv.	6s	1944 100½	99 101½
Central Ind. Pwr.	6s	1947 99½	98 99½
Central Ia. Pwr. & Lt.	6s	1944 100	99½ 101
Central Maine Power	5s	1939 99½	98½ 100
Central N. Y. Gas & El.	5s	1941 *k* 98	....
Central Pwr. & Lt.	6s	1946 *m*101½	....
Central Pwr. & Lt.	6½s	1952 *k*105	....
Central States Elec.	6s	1945 *k* 93	....
Chattanooga Ry. & Lt.	5s	1956 89½	81 90
Cincinnati Gas & Elec.	5s	1956 102½	102 103½
Cincinnati Gas & Elec.	5½s	1961 104½	102½ 105½
Cities Service	6s	1966 *k* 91½	91½ 93½
Cities Service	7sB	1966 *k*186	....
Cities Service	7sC	1966 *k*129½	125½ 131
Cities Service	7sD	1966 *k*103½	101½ 104
Cities Service	7sE	1966 *k*109	....
Cities Service Pwr. & Lt.	6s	1944 *k* 95½	93½ 96½
City L. & T., Sedalia, Mo	5s	1952 85½	83 85½
Cleveland Elec. Illum.	5s	1939 103	102½ 103½
Cleveland Elec. Illum.	5s	1954 *k*103	....
Cleveland Elec. Illum.	7s	1941 111	110 112
Colorado Pwr.	5s	1953 98½	95½ 98
Columbia Gas & Elec.	5s	1927 *k*100½	....
Columbia Ry., Gas & El.	5s	1936 93	92½ 95
Columbus, Dela. & Marion Elec.	5s	1937 86	83½ 86
Columbus, Dela. & Marion Elec.	6s	1937 94½	93½ 96
Columbus Elec. & Pwr.	6s	1947 *k*103	....
Columbus Ry., Pwr. & Lt.	5s	1940 *k* 98	....
Columbus Ry., Pwr. & Lt.	6s	1941 *k*104	....
Commonwealth Edison	5s	1943 *k*102½	....
Commonwealth Edison	5s	1953 101½	99½ 102
Commonwealth Edison	5s	1954 *k*101	....
Commonwealth Pwr.	5s	1939 *k* 92½	....
Commonwealth Pwr.	6s	1972 *k* 97	....
Commonwealth Pwr.	6s	1947 *k*104½	....
Community Pwr. & Lt.	6s	1950 100	98 100½
Conn. Ry. & Ltg.	4½s	1951 90½	90½ 92
Consol. Cities Lt., Pwr. & Trac.	5s	1962 80	80 82½
Consol. Elec.	5s	1955 97½	98 99
Consol. Gas of N. Y.	5½s	1945 *k*106½	....
Con. Gas, Elec. Lt. & Pwr. of Balti.	4½s	1935 *c* 98	95½ 98½
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	6s	1949 *c*107½	105½ 107½
Con. Gas, Elec. Lt. & Pwr. of Balti.	5s	1965 *m*101½	100 101½
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	5½s	1952 *c*105½	104½ 105½
Con Gas, Elec. Lt. & Pwr. of Balti. (notes)	6½s	1951 *m*109½	109 109½
Consumers Elec. L. & P.	5s	1936 *k* 98	....
Consumers Pwr.	5s	1936 *k*101	....
Consumers Pwr.	5s	1952 *k*101	....
Consumers Pwr.	5½s	1954 *k*104½	....
Continental Gas & Elec.	5s	1927 *k*100	....
Continental Gas & Elec.	6s	1947 *k*101½	....
Continental Gas & Elec.	6½s	1964 *k* 99½	....
Continental Gas & Elec.	7s	1954 *k*105½	....
Cumberland Cty. Pw.& Lt.	5s	1942 97	94 97½
DALLAS PWR. & LT.	6s	1949 104½	104 105
Dayton Ltg.	5s	1937 100	100 101
Dayton Pwr. & Lt.	5s	1941 102	100 102½
Defiance Gas & Elec.	5s	1942 98½	98 99
Denver Gas & Elec.	5s	1949 99	98 100
Denver Gas & Elec. Lt.	5s	1951 96½	94 97½
Des Moines Elec.	5s	1938 101	99 101
Detroit Edison	5s	1933 102	101 102½
Detroit Edison	5s	1940 102½	100½ 102½
Detroit Edison	5s	1949 102	100 102½
Detroit Edison	5s	1955 101½	100½ 101½
Detroit Edison	6s	1932 *m*124½	124½ 135
Detroit Edison	6s	1940 108½	106 108½
Detroit Edison	7s	1928 *m*131½	124½ 134
Detroit Edison	7s	1929 *m*131	124½ 131
Detroit Edison	7s	1930 *m*131	124½ 138½
Dominion Pwr. & Trans	5s	1932 96	95 97
Driver-Harris	8s	1931 97½	95 98½
Dubuque Elec.	6s	1942 102½	102 103½
Duke-Price Pwr.	6s	1949 107	102 106
Duke Price Pwr.	6s	1966 *k*101½	100½ 101½
Duquesne Lt.	6s	1949 105½	105½ 107
Duquesne Lt.	5½s	1949 105½	105 106½
Durham Pub. Serv.	7s	1949 100½	99 101½
EAST PENN. ELEC.	6s	1953 104½	105 106
East. N. J. Pwr.	6s	1949 101	99 101½
East Oregon Lt. & Pwr.	6s	1929 100	100 101
East. Tex. Elec.	5s	1942 *k* 97	....
Economy Lt. & Pwr.	5s	1956 98½	99 100
Edison Elec. Illum. of Boston (notes)	4½s	1928 99½	99½ 100½
Edison Elec. Illum. of Bklyn.	4s	1939 94½	93 99½
Edison El. Illum. (N.Y.)	5s	1995 105½	103 105
El Paso Elec.	5s	1932 *m*102	....
El Paso Elec.	5s	1950 97½	95 98
El. Pwr. Corp. (Germany)	6½s	1950 *k* 88½	....
Elec. Refrigeration	6s	1936 105	100½ 107
Elmira Wtr., Lt. & R.R.	5s	1956 97	96 97½
Empire Dist. Elec.	5s	1949 94	92 94½
Erie Ltg.	5s	1967 99½	99 100½
Evansville G. & El. Lt.	5s	1932 99	99 100
FEDERAL LT. & TRAC.	5s	1942 95½	92½ 97½
Federal Lt. & Trac.	6s	1942 102	100 104½
Federal Lt. & Trac.	6s	1954 93½	93 96
Florida Power & Light	5s	1954 *k* 95	91½ 95
Florida Publ. Service	6s	1955 97	97 99
Florida Public Service	6½s	1949 99½	99 103
Ft. Smith Lt. & Trac.	5s	1936 *k* 81	....
Ft. Worth Pwr. & Lt.	5s	1931 100½	99 100½
GALVESTON ELEC.	5s	1940 88	89 92
General Elec.	3½s	1942 91	87 90
Georgia Carolina Pwr.	5s	1952 20½	87 91
Ga. Lt., Pwr. & Rys.	5s	1941 87	88 92
Ga. Ry. & Elec.	5s	1932 99½	98½ 100½
Ga. Ry. & Elec.	5s	1949 95½	94½ 97
Ga. Ry. & Pwr.	5s	1954 98	96 99
Ga. Ry. & Pwr.	6s	1947 *k*104	....
Ga. Ry. & Pwr.	7s	1941 *k*105	....
German Gen. Elec.	6½s	1940 *k* 98½	94 99½
German Gen. Elec.	7s	1945 97½	....
Great Cons. Elec. Pwr. (Japan)	6½	1950 *k* 85½	85 86
Great Cons. Elec. Pwr. (Japan)	7s	1944 *k* 92½	....
Great Falls Pwr.	5s	1940 104	101½ 104½
Great Northern Pwr.	5s	1935 99½	98½ 100½
Great Western Pwr.	5s	1946 *k* 99½	....
Great Western Pwr.	5½s	1955 100	99 101
Great Western Pwr.	6s	1949 102½	102 103½
Great Western Pwr.	6s	1952 *k*103	....
HAMBURG ELEC.	7s	1935 *k* 95½	94 97½
Havana Elec. R., Lt. & P	5s	1954 94½	92½ 95
Holtwood Pwr.	6s	1954 104½	100 104½
Houston Ltg. & Pwr.	5s	1931 100	99 101
Houston Ltg. & Pwr.	5s	1953 96½	90½ 95½
Houston Ltg. & Pwr.	5½s	1954 100½	99½ 102½
Hydraulic Pwr.	5s	1951 101½	101½ 102
Hydraulic Pwr.	5s	1950 101½	101½ 103
IDAHO PWR.	5s	1947 98½	96 98½
Ill. Elec. Pwr.	6s	1943 103½	102 103½
Ill. Pwr.	5s	1933 *k* 95½	....
Ill. Pwr.	6s	1944 *k* 98½	....
Ill. Pwr. & Lt.	5½s	1954 98½	97½ 99
Ill. Pwr. & Lt.	6s	1953 102	100½ 102½
Ill. Pwr. & Lt.	7s	1953 102	102 103½
Ind. Elec.	6s	1947 99	98 100
Ind. Gen. Serv.	5s	1948 98½	96½ 98½
Ind. Lighting	4s	1958 83½	82½ 84
Indiana & Mich. Elec.	5s	1955 98½	96 98½
Indiana & Mich. Elec.	5s	1957 100	97½ 100½
Ind. Service	5s	1950 93½	91½ 93½
Ind. Service	6s	2020 86	83 88½
Ingersoll-Rand	5s	1935 100	....
International Pwr. Sec.	6½s	1955 *l* 91	....
Interstate Elec.	6s	1933 96½	94 98½
Interstate Pwr.	6s	1944 *k* 99	....
Interstate Pwr.	7s	1934 *k*100½	....
Interstate Pub. Serv.	6s	1948 99½	98 99½
Iowa Ry. & Lt.	5s	1932 99	97½ 100
Iowa Southern Utilities	5½s	1950 94	94 96
Inter. Pwr. Sec.	6½s	1955 *f*90½	....
JERSEY CENT. PWR. & LT.	5½s	1945 96½	95 98
KANSAS CITY PWR. & LT.	5s	1952 *k*103	....
Kansas Elec. Pwr.	6s	1937 *k*101½	....
Kansas Elec. Pwr.	6s	1943 102	99½ 102½
Kansas Gas & Elec.	6s	1952 105	101½ 105½
Kansas Gas & Elec.	6s	2022 94	92½ 93½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high. Tuesday, May 11. *l*Bid, low, high, Wednesday, May 12. *m*Latest quotations available. *n*1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies		Bid Price Saturday May 8	Low 1926	High 1926
BONDS (Continued)				
Kentucky Hydro Elec....	6s	1949	100½	99½	101½
Kentucky Utilities.....	6s	1949	103½	99½	102½
Kings Cty. Elec. L. & P..	5s	1937	102½	102	103½
Kings Cty. Elec. L. & P..	6s	1997	123½	120½	123½
Kings County Ltg.....	5s	1954	100	98½	100½
Kings County Ltg.....	6s	1954	109	106	110
Knoxville Ry. & Lt.....	5s	1946	97½	95½	98
LACLEDE GAS LT.....	5s	1934	100½	100	101½
Laclede Gas Lt.....	5½s	1953	k104½	....	....
Laurentian Pwr.....	6s	1936	100½	100	101
Laurentide Pwr.....	5s	1946	100	100	102
Lehigh Pwr. Sec.....	6s	2026	95	93	95½
Lincoln Gas & Elec.....	5s	1941	94½	92½	94½
Long Island Ltg.....	5s	1936	k100½	....	....
Long Island Ltg.....	6s	1954	101½	99½	102
Long Island Ltg.....	6s	1948	107½	104½	108
Los Angeles Gas & Elec..	5s	1939	k100½	....	....
Los Angeles Gas & Elec..	5½s	1943	101½	99	102
Los Angeles Gas & Elec..	5½s	1947	k101½	....	....
Los Angeles Gas & Elec..	5½s	1949	101½	99	102
Los Angeles Gas & Elec..	6s	1942	105½	102½	105½
Louisiana Pwr.....	6s	1944	99½	98½	100
Louisville Gas & Electric.	6s	1937	101	100	102
Louisville Gas & Elec....	5s	1952	k 99½	....	....
Louisville Gas & Elec....	5½s	1954	104	102	104½
Lower Austrian Hydro El.	6½s	1944	84	82½	87½
Luzerne Cty. Gas & El...	5s	1948	99½	97½	99½
Luzerne Cty. Gas & El...	7s	1944	105	103½	105½
Luzerne Cty. Gas & El...	6s	1954	103½	102	104
MADISON RIV. PWR..	5s	1935	100½	100	101
Manila Elec.....	7s	1942	114½	102	115½
Manila Elec. Ry. & Ltg..	5s	1953	92	89½	94
Manitoba Pwr.....	5½s	1951	k 97½	94½	98
Memphis Pwr. & Lt.....	5s	1948	99½	99	100½
Metropolitan Edison.....	6s	1952	100	104	108
Metropolitan Edison.....	5s	1953	100½	96½	101½
Metropolitan Pwr.....	6s	1953	104½	102½	104½
Michigan Lt.....	5s	1946	k 99½	....	....
Michigan No. Pwr.....	5s	1941	99½	97	100
Milwaukee El. Ry. & Lt..	4½s	1931	98½	97	99
Milwaukee El. Ry. & Lt..	5s	1951	99½	98½	100½
Milwaukee El. Ry. & Lt..	5s	1961	k 95½	....	....
Milwaukee El. Ry. & Lt..	6s	1953	104½	100½	104½
Minn. Pwr. & Lt.....	5s	1955	97½	95½	97
Minn. Pwr. & Lt.....	6s	1950	105½	104	106
Miss. Power.....	5s	1955	93	92	94
Miss. River Pwr.....	5s	1951	99½	99	100½
Miss. River Pwr.....	7s	1935	101½	102	103
Mo. Edison Elec.....	5s	1927	m100½	100½	100½
Mo. Pwr. & Lt.....	5½s	1955	97½	96	98½
Mobile Elec.....	5s	1946	k 98½	....	....
Monongahela W. Pa. Pub. Service.....	5½s	1953	96	95	97½
Montana Pwr.....	5s	1943	k101½	....	....
Montreal Lt., Ht. & Pwr.	4½s	1932	97½	97	98½
Montreal Lt., Ht. & Pwr.	5s	1933	99½	99½	101
Montreal Pub. Serv.....	5s	1942	94½	94	95½
Mountain States Pwr.....	6s	1938	100	98½	101
Municipal Service.....	5s	1942	93	92½	93½
NASHVILLE RY. & LT.	5s	1953	98½	96½	98½
Nashville Ry. & Lt.....	5s	1958	92½	90½	93
Nassau Lt. & Pwr.....	5s	1927	99½	98½	100½
Nassau & Suffolk Ltg....	5s	1945	92½	89½	93
National Elec. Power.....	6s	1945	92½	92½	94
National Pwr. & Lt.....	7s	1972	k101	....	....
National Pub. Serv.....	6½s	1955	95	94½	97
Nebraska Pwr.....	5s	1949	100½	99	101½
Nebraska Pwr.....	6s	2022	97½	94½	98
Nevada-Calif. Elec.....	6s	1946	k102	....	....
Nevada-Calif. Elec.....	6s	1950	151	98½	101½
New Brunswick Pwr.....	5s	1937	83½	81½	85
New England Pwr.....	5s	1951	103½	100½	104½
New Jersey Pwr. & Lt....	5s	1936	99	96½	99
New Orleans Pub. Serv...	4½s	1935	89½	87	89½
New Orleans Pub Serv.,B.	5s	1952	k 95½	....	....
New Orleans Pub. Serv...	5s	1955	95½	90½	96½
New Orleans Pub. Serv...	6s	1949	91½	90	92½
N.Y. & Queens El. L.&P..	5s	1930	101½	100½	103½
N.Y. & Westchester Ltg..	4s	2004	81½	79½	81½
N.Y. & Westchester Ltg..	5s	1954	98½	97½	98½
New York Edison.....	6½s	1941	k116½	....	....
New York Edison.....	5s	1944	k104½	....	....
N.Y. Gas & El. L., H.&P.	5s	1948	104½	104	105
N.Y. Gas & El. L., H.&P.	4s	1949	90½	89½	91½
N.Y. State Gas & Elec...	5½s	1962	101	100	101
Newport News & Hampton Ry., Gas & Elec....	5s	1944	90	89½	91
Niagara Falls Pwr.....	5s	1932	102½	100½	103
Niagara Falls Pwr.....	6s	1932	105	104½	106½
Niagara Falls Pwr.....	6s	1950	106½	105	107
Niagara, Lock. & Ont. Pwr.	5s	1955	k100½	....	....
Niagara, Lock. & Ont. Pwr.	6s	1958	m106	....	....
Norfolk Ry. & Lt.....	5s	1949	95½	94	96½
No. Amer. Edison.....	6s	1952	104½	101½	105
No. Amer. Edison.....	6½s	1948	105½	103½	106
No. Amer. Lt. & Pwr....	7s	1954	98½	99	100½
North Caro. Pub. Serv...	5s	1934	k 94	....	....
North Caro. Pub. Serv...	6s	1954	96	94½	97
North Caro. Pub. Serv...	6½s	1944	99	98	100½
North Shore Elec.....	5s	1940	100½	98½	101
No. Calif. Pwr.....	5s	1948	100½	99½	101½
No. Ind. Gas & Elec.....	5s	1929	99½	99	100
No. Ind. Gas & Elec.....	6s	1952	104½	101½	105
Northern N. Y. Utilities..	5s	1955	97½	95	98
Northern N. Y. Utilities..	5½s	1949	100½	100	101½
No. Ohio Pwr.....	7s	1935	k 93	....	....
No. Ohio Trac. & Lt.....	4s	1933	90	87	91
No. Ohio Trac. & Lt.....	5s	1956	84½	84	86
No. Ohio Trac. & Lt.....	6s	1926	99½	99	100
No. Ohio Trac. & Lt.....	6s	1947	95½	92½	96½
No. States Pwr.....	6½s	1933	k111½	108	132
No. States Pwr. (notes)....	6½s	1933	k103½	102½	104
No. States Pwr.....	6s	1948	k103½	....	....
No. States Pwr.....	6s	1941	106	105½	106½
No. States Pwr.....	5s	1941	k101	....	....
No. Tex. Elec.....	5s	1940	68	72	75
Northwestern Elec.....	6s	1935	102½	102	103½
Northwestern Pub. Serv..	6½s	1948	101½	99½	102½
Nova Scotia Tr. & Pwr...	5s	1946	88	88	90
OHIO PWR.....	5s	1952	98	94	98½
Ohio Pwr.....	6s	1953	104½	103½	104½
Ohio Pwr.....	6s	2024	98	95½	98½
Ohio Pwr.....	7s	1951	106	105½	106½
Ohio Pub. Serv.....	5s	1954	95½	92½	96½
Ohio Pub-Serv.....	6s	1953	101½	101	102½
Ohio Pub. Serv.....	7½s	1946	112½	112½	113½
Ohio Pub. Serv.....	7s	1947	112	110½	112
Ohio River Edison.....	6s	1948	103½	101½	104½
Okla. Gas & Elec.....	5s	1950	94	93	94½
Okla. Gas & Elec.....	6s	1940	k 96	....	....
Ontario Pwr. of Niagara Falls.....	5s	1943	k101½	....	....
Ontario Transmission.....	5s	1945	101	99½	99½
Ozark Pwr. & Wtr.....	5s	1952	84	77	84
PACIFIC COAST PWR..	5s	1940	99½	99	100½
Pacific Gas & Elec.....	5s	1942	k 99½	....	....
Pacific Gas & Elec.....	5½s	1952	104	101½	104½
Pacific Gas & Elec.....	6s	1941	k108	....	....
Pacific Lt. & Pwr.....	5s	1942	101	100	101½
Pacific Lt. & Pwr.....	5s	1951	100½	100	101½
Pacific Pwr. & Lt.....	5s	1930	100	99½	101
Pacific Pwr. & Lt.....	5s	1953	m96½	....	....
Parr Shoals Pwr.....	5s	1952	97½	95	98½
Paterson & Passaic G.&E.	5s	1949	102	100	101½
Penn Central Lt. & Pwr...	5½s	1975	95½	94½	97
Penn Central Lt. & Pwr...	6s	1953	104	102½	105
Penn Edison.....	5s	1946	98½	96½	98½
Penn. Elec.....	6s	1955	m105	92	105
Penn Elec. of Cal.....	6½s	1954	m105	97	100½
Penn.-Ohio Edison.....	6s	1950	102½	98½	106
Penn Ohio Elec.....	6½s	1938	105½	105	107
Penn Ohio Pwr. & Lt.....	5½s	1954	k100	....	....
Penn Ohio Pwr. & Lt.....	6s	1939	98	97	98½
Penn Pwr. & Lt.....	5s	1952	99½	97½	99½
Penn Pwr. & Lt.....	5s	1953	99½	97½	99½
Penn Pwr. & Lt.....	6s	1953	105½	105	106
Penn Pwr. & Lt.....	7s	1951	106	105½	106½
Penn Pub. Serv.....	5s	1954	97½	96	98½
Penn Pub. Serv.....	6s	1947	104½	103	105
Penn Wtr. & Pwr.....	5s	1940	101½	101½	102½
Penn Wtr. & Pwr.....	5½s	1953	103½	102½	103½
Phila. Co.....	6s	1944	k104½	....	....
Phila. Co.....	5½s	1938	k101	....	....
Phila. Co.....	5s	1951	98½	97½	99½
Phila. Co.....	5s	1949	m104½	103½	104½
Phila. Elec.....	5s	1966	c103½	102	104½
Phila. Elec.....	4s	1966	m 87½	84	87½
Phila. Elec.....	5s	1960	c102½	102	103½
Phila. Elec.....	6s	1941	c107½	107½	108½
Phila. Elec.....	5½s	1947	c107½	103½	107½
Phila. Elec.....	5½s	1953	c107½	103½	107½
Phila. Elec. Pwr.....	5½s	1972	k102½	100½	102½
Portland Elec. Pwr.....	6s	1947	k101½	....	....
Portland Gen. Elec.....	5s	1935	102	99½	102½
Portland Ry., Lt. & Pwr..	5s	1942	92½	88½	94½
Portland Ry., Lt. & Pwr..	6s	1947	101	99	102½
Portland Ry., Lt. & Pwr..	7½s	1946	107½	106½	108½
Potomac Edison.....	6s	1949	100	99	100½
Potomac Edison.....	6½s	1948	103½	103	104
Potomac Elec. Pwr.....	5s	1929	j100½	....	....
Potomac Elec. Pwr.....	5s	1936	j100½	....	....
Potomac Elec. Pwr.....	6s	1953	j106½	....	....
Potomac Elec. Pwr.....	7s	1941	j106½	....	....
Power Corp. of N. Y....	6s	1942	100½	101	101½
Power Corp. of N. Y....	6½s	1942	101½	104	105½
Power Securities.....	6s	1949	k 77	....	....
Pub. Lt. & Pwr.....	5s	1945	67	68	73
Pub. Serv. Co. of Colo....	5½s	1954	96	95	96½
Pub. Serv. Co. of Colo....	6s	1953	100½	100	101½
Pub. Serv. Co. of Colo....	7s	1933	101	101½	102½
Pub. Serv. Corp. of N.J..	5s	1959	m101	104½	105
Pub. Serv. Corp. of N.J..	6s	1944	k103½	....	....
Pub. Serv. Co. of No. Ill..	5s	1956	99	98	99½
Pub. Serv. Co. of No. Ill..	5½s	1962	104½	103½	105
Pub. Serv. Co. of No. Ill..	5½s	1964	104½	103½	105½
Pub. Serv. Co. of Okla....	6s	1949	102½	98½	102½
Pub. Serv. Elec. & Gas....	5½s	1959	k105½	....	....
Pub. Serv. Elec. & Gas....	5½s	1964	k105	....	....
Pub. Util. Evansville, (Ind.)	6s	1929	k100½	....	....
Puget Sound Pwr.....	5s	1933	100½	99	101½
Puget Sound Pwr. & Lt...	5½s	1949	k101	....	....
QUEBEC PWR.....	6s	1953	103½	101½	104
Queensborough Gas & E..	5s	1952	100	99½	100½
Queensborough Gas & E..	6s	1953	103½	104	105½
Quincy (Ill.) Gas, Elec. and Heat.....	5s	1935	94½	93	94½
RHINE-WESTPHALIA ELECTRIC PWR.....	7s	1950	k 96	93½	96½
Rio de Janeiro Tram., Lt. & Pwr.....	5s	1935	94	93	94½
Robbins & Myers.....	7s	1952	63	58	68½
Rochester Gas & Elec....	5½s	1944	105	104½	106
Rochester Gas & Elec....	7s	1946	111½	111½	114
Rochester Ry. & Lt.....	5s	1954	101	100½	101½
Rockford Elec.....	5s	1939	100½	99½	100½
Rome Wire.....	6s	1940	98	98	100½
ST. MAURICE PWR...	6½s	1953	108	108	109½
St. Paul Gas Lt.....	5s	1944	101	100½	101½
St. Paul Gas Lt.....	5½s	1954	101½	101	102½
St. Joseph Ry., Lt., H.&P.	5s	1937	95½	91½	97
Salt River Valley Wtr....	6s	1938	k100	....	....
Salmon River Pwr.....	5s	1952	100½	100½	101½
San Antonio Gas & Elec..	5s	1949	96½	96	97½
San Antonio Pub. Serv..	6s	1952	103½	101½	104
San Diego Cons. G.&E....	5s	1939	k100	....	....
San Diego Cons.G.&E....	6s	1939	102½	101	102½
San Joaquin Lt. & Pwr...	5s	1945	100	98½	100
San Joaquin Lt. & Pwr...	6s	1950	104	103	104½
San Joaquin Lt. & Pwr...	6s	1952	104	99½	104
San Joaquin Lt. & Pwr...	6s	1954	103½	100½	103½
Sauda Falls.....	5s	1955	k 95½	93½	96
Savannah Elec. & Pwr....	7½s	1941	k106½	....	....
Saxon Pub. Wks. (Germany).....	7s	1945	k 95½	....	....
Scranton Electric.....	5s	1937	101½	101½	102½
Seattle Elec.....	5s	1930	100½	100½	101½
Seattle Elec.....	5s	1929	99½	99½	100½
Seattle Elec.....	5s	1939	93½	92½	94½
Seattle Ltg.....	5s	1949	93½	90½	94
Servel Corp.....	6s	1931	k102½	99½	104½
Shawinigan Wtr. & Pwr..	5s	1934	100½	100	101½
Shawinigan Wtr. & Pwr..	5½s	1950	104½	103½	105
Shawinigan Wtr. & Pwr..	6s	1950	104	104½	105½
Sheboygan Elec.....	5s	1946	97½	94½	98
Siemens & Halske.....	7s	1928	k 99½	96	100½
Siemens & Halske.....	7s	1935	97½	94	97
Sierra & San Fran. Pwr...	5s	1949	k 76	....	....
Sierra & San Fran. Pwr....	6s	1949	k 90	....	....
Sioux City Gas & Elec....	6s	1947	102½	101½	103½
Sioux City Gas & Elec....	6s	1949	102½	102	103½
So. Caro. Gas & Elec.....	6s	1942	91	78	97
So. Caro. Gas & Elec.....	6s	1932	80	70	82
Southeast Pwr. & Lt.....	6s	2025	k 93½	89	94½
So. Cal. Edison.....	5s	1939	k100½	....	....
So. Cal. Edison.....	5s	1944	99½	98	99½
So. Cal. Edison.....	5½s	1944	104½	103	105
So. Cal. Edison.....	6s	1943	104	102	104
So. Cal. Edison.....	6s	1944	k105½	....	....
So. Cities Utilities.....	5s	1931	99	99	102
Southern Colo. Power....	6s	1947	98½	97½	99½
So. Ind. Gas & Elec.....	6s	1947	k 99	....	....
Southern Pwr.....	5s	1930	100½	100	101
So. Public Utilities.....	5s	1943	100½	100	101½
So. Sierras Pwr.....	6s	1936	k105	....	....
So. Wisconsin Pwr.....	5s	1938	92½	91	93
Southwestern Gas & E....	5s	1932	97½	97	98½
Southwestern Gas & E....	6s	1957	98	97½	99½
Southwestern Lt. & Pwr..	6s	1937	98	98	99½
Southwestern Power.....	6s	1944	96½	96½	98
Southwestern Pwr. & Lt..	5s	1943	95½	94	96½
Southwestern Pwr. & Lt..	6s	2022	94½	94	96½
Southwestern Pub. Serv..	6s	1945	94	94	96
Southwestern Utilities....	8s	1936	109	92½	96
Springfield Lt., Ht. & Pwr.	5s	1933	98½	99	100½
Standard Elec. of Cal....	5s	1939	100	99½	101
Standard Gas & Elec.....	6s	1935	k100	....	....
Staten Island Edison.....	6½s	1953	105½	106	107½
Superior Water, Lt. & Pwr.	4s	1931	94½	94½	95½
Syracuse Ltg.....	5s	1951	101½	100	101½
Syracuse Ltg.....	5½s	1954	104½	103½	104½
TAMPA ELEC.....	5s	1933	k100	....	....
Tenn. Elec. Pwr.....	6s	1947	k105½	....	....
Tenn. Pwr.....	5s	1962	96½	96	97
Tex. Pwr. & Lt.....	5s	1937	99½	98½	100
Tex. Pwr. & Lt.....	6s	2022	97½	95½	97
Tide Water Pwr.....	6s	1942	101½	100	101½
Tide Water Pwr.....	7s	1937	103	100	107
Toho Elec. Pwr. (Japan) .	7s	1955	k 92½	....	....
Tokyo Elec. (Japan).....	6s	1928	k 98½	....	....
Toledo Edison.....	5s	1947	100½	100	100½
Toledo Edison.....	7s	1941	k108½	....	....
Toledo Gas, Elec. & Htg.	5s	1935	100½	98	100½
Toledo Tr., L.&P. (notes)	5½s	1930	98½	....	....
Topeka Edison.....	5s	1950	99	99	100
Topeka Ry. & Lt.....	5s	1933	94½	94½	96½
Trenton Gas & Elec.....	5s	1949	102½	100½	102½
Tri-City Ry. & Lt.....	5s	1930	k 98	....	....
Twin State Gas & Elec...	5s	1953	96½	95	96½
Twin State Gas & Elec...	5½s	1945	100	98	100½
Tyrol Hydro-Elec. Pwr...	7½s	1955	k 96	....	....
UJIGAWA ELEC PWR.	7s	1945	92	92	94
Union Elec. Lt. & Pwr...	5s	1932	101	100½	101½
Union Elec. Lt. & Pwr...	5s	1933	100½	100½	101½
Union Elec. Lt. & Pwr...	5s	1954	101½	99½	101
Union Elec. Lt. & Pwr...	5½s	1954	k101½	....	....
United Elec. of N.J.....	4s	1949	88½	87½	89
United Elec. Lt. & Pwr...	4½s	1929	98	98	99½
United Lt. & Pwr. (notes)	5½s	1928	99½	99	100½
United Lt. & Pwr.....	5½s	1959	96	96	97½
United Lt. & Pwr.....	6½s	1974	97	95½	98½
United Lt. & Rys.....	5s	1932	k 96½	....	....
United Lt. & Rys.....	6s	1926	99½	100	101½
United Lt. & Rys.....	6s	1952	100½	99	101½
United Lt. & Rys.....	6s	1973	90	89½	92
United Pwr. & Lt.....	6s	1944	102	102	103½
United Water, G. & E....	5s	1941	95½	94	95
Utah Lt. & Trac.....	5s	1944	k 92½	....	....
Utah Pwr. & Lt.....	5s	1944	k 97½	....	....
Utah Pwr. & Lt.....	6s	1944	103	102½	104½
Utah Pwr. & Lt.....	6s	2022	94½	88½	95
Utica Elec. Lt. & Pwr....	5s	1950	102½	100½	102½
Utica Gas & Elec.....	5s	1957	101½	100½	102½
Utica Gas & Elec.....	5½s	1949	104½	103½	104½
VERMONT HYDRO - ELEC.....	6s	1929	100	100	101
Vicksburg Lt. & Trac....	5s	1932	95	93½	95½
Virginian Pwr.....	5s	1942	98½	88	99
Virginian Pwr.....	6½s	1954	m103½	103	104½
Virginia Ry. & Pwr.....	5s	1943	k 98½	....	....
Virginia-Western Pwr....	6s	1953	105	101½	106½
WAGNER EL. MFG....	7s	....	b100½	100	101½
Washington Coast Util...	6s	1941	102½	102½	103½
Washington Ry. & Elec...	4s	1951	f 81½	....	....
Washington Ry. & Elec...	6s	1933	j103	....	....
Washington Wtr. Pwr....	5s	1939	102	101½	102½
West Penn Pwr.....	5s	1963	102½	99½	102½
West Penn Pwr.....	5s	1946	k101½	....	....
West Penn Pwr.....	5½s	1953	k105	....	....
West Penn Pwr.....	7s	1946	k106½	....	....
W. Va. Lt., Ht. & Pwr...	6s	1929	101½	101	102½
West Virginia Utilities....	6s	1935	98½	95½	99
W. Va. Water & Elec.....	6½s	1942	m103½	102½	104
Westchester Ltg.....	5s	1950	102½	102	103½
Western Elec.....	5s	1944	k102½	....	....
Western N. Y. Utilities...	5s	1946	97½	96½	98
Western Pwr.....	6½s	1954	100½	100	102
Western Pow r of Cana da	5s	1949	94½	94	95½
Western Pub. Service....	6s	1950	98½	98	99½
West States Gas & Elec...	5s	1941	100	98½	100½
West States G.&E. (notes)	6s	1937	94½	94½	96
West States Gas & Elec...	6s	1947	k 99½	....	....
West United Gas & El....	5s	1950	102	101½	102½
Westphalia Un. Elec. Pwr	6½s	1950	m 98½	....	....
Westinghouse Elec. & Mfg.	7s	1931	k106½	....	....
Wheeling Elec.....	5s	1941	99	99	100
Wichita R. R. & Lt.....	5s	1932	84½	83	88
Winnipeg Elec.....	6s	1954	96½	96½	97½
Wisconsin Elec. Pwr....	5s	1954	99½	98½	100
Wisconsin Gas & Elec....	5s	1952	k 99½	....	....
Wis.-Minn. Lt. & Pwr....	5s	1944	k 97	....	....
Wisconsin Pwr., Lt. & Ht	5s	1946	93½	92	94½
Wisconsin Pub. Service...	6s	1952	101½	101	102½
Wis. Ry., Lt. & Pwr.....	5s	1933	95½	94½	96½
Wis. River Pwr.....	5s	1941	100½	99½	101½
Wolverine Pwr.....	7s	1943	101½	100	101½
YADKIN RIVER PR..	5s	1941	k100½	....	....
Yarmouth Lt. & Pwr.....	5s	1937	83½	83½	87
Yarmouth Lt & Pwr.....	8s	1951	102	99	102

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Tuesday, May 11. lBid, low, high, Wednesday, May 12. mLatest quotations available. n1926.

Manufacturing and Markets

Opinions of the Business Prospects

That Indications for Continued Prosperity Are Encouraging Is the View Held by Leading Manufacturers—Active Months Ahead If Business Is Sanely Handled

AMONG more than one hundred replies received from electrical manufacturers in response to a request from the ELECTRICAL WORLD asking for a preliminary report as to business conditions there was not a single pessimistic note evident. Four or five manufacturers said that there was a tendency toward pessimism in their territory, but, on the other hand, these same manufacturers said that their own business did not warrant such an attitude. Refrigerator companies refer to sales as exceptionally good. A large refrigerator manufacturer says: "Our opinion on 1926 possibilities is amply explained by the fact that our preparations for this year's activities included arrangements to more than quadruple our 1925 production." Some of the other replies received from representative manufacturers of various equipment are as follows:

1. "We are very optimistic regarding our business prospects for the rest of the year, for as long as industry maintains its 'pioneer' state of mind we have nothing to worry about."

2. "Seems rather uncertain, although we are busy just now."

3. "We can see nothing fundamentally wrong which would lead us to believe other than that we shall have a good steady business for the rest of the year."

4. "We individually are figuring that if we do more advertising and hustle a lot more in selling, we ought to be able to increase our business 25 per cent over last year. Our general opinion is that nobody will increase his business over last year's who does not do a far better selling job in 1926 than he did in the year previous. The basic conditions taken month in and month out will not be any better."

5. "Our business so far this year is 33⅓ per cent above the corresponding period in 1925. We expect to maintain this increase for the full year."

6. "There is every indication that business during 1926 will be very satisfactory. Sales for the first quarter of this year exceed those for the same period last year, which is very satisfactory both in the matter of volume and general conditions."

7. "Based on the first three months' business and on the continuation of consumer demand, the present year's outlook is even better than the outlook in the corresponding period last year."

8. "The volume of orders received since Jan. 1 is considerably greater than for the same period last year or in previous years, and we have every reason to believe that demands will continue during the year."

Indications are thus encouraging for the continuance of the prosperity which has obtained during recent months. The industry can also look back at the auspicious features of the business of 1925 as a basis for today's prosperity. Those features included the agricultural yield, which in quantity and price on the whole gave a satisfactory return to the large portion of the population gaining their livelihood from this fundamental occupation; the production of the metalliferous ores, coal, oil, etc., which were all actively and profitably exploited and added their quota in more than usual degree to the common store of wealth, notwithstanding the serious interruption of coal mining in the districts where labor complications prevented operations; the production of manufactured articles, active and growing in a cumulative degree, and particularly in the basic lines of the iron and steel industry; the building program, which was a busy one and gave highly paid employment to large numbers of workers in processes consuming unusual quantities of raw and manufactured materials, and the business of transportation, which grew out of all the foregoing and which reached a high rate of movement in practically every section of the country.

All these provided a purchasing power well distributed throughout the community, which in turn worked for the continuance of that business which is active and capable of being done at a profit. Working in the same direc-

(Continued on page 1083)

Value of Electrical Exports for March, 1926, Compared with Corresponding Month in 1925

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	March 1925	March 1926
Generators:		
Direct-current:		
Under 500 kw.	$86,186	$72,207
500 kw. and over	94,383	37,671
Alternating-current:		
Under 2,000 kva.	27,590	9,246
2,000 kva. and over	121,550	46,028
Steam-turbine generator sets.	222,183	15,255
Accessories and parts for generators	109,653	103,567
Self-contained lighting outfits	66,311	79,948
Batteries:		
Flashlight batteries	133,185	141,652
Other primary batteries	97,095	140,793
Storage batteries	245,100	266,142
Transforming or converting apparatus:		
Power transformers	99,856	350,727
Other transformers	176,002	75,036
Rectifiers, double-current and motor generators, dynamotors, synchronous and other converters	55,375	208,239
Transmission and distribution apparatus:		
Switchboard panels, except telephone	284,343	320,127
Switches and circuit breakers over 10 amp	201,367	165,204
Fuses and fuse blocks	35,094	33,442
Watt-hour and other measuring meters	36,364	79,077
Volt, watt and ampere meters and other recording, indicating and testing apparatus	135,602	188,668
Lightning arresters, choke coils, reactors and other protective devices	44,603	59,735
Motors, starters and controllers:		
Motors, under 1 hp.	202,626	170,621
Stationary motors:		
1 to 200 hp.	238,222	433,194
Over 200 hp	73,029	86,679
Railway motors	65,827	17,258
Electric locomotives:		
Railway	3,411	341,120
Mining and industrial	17,716	7,988
Starting and controlling equipment for:		
Industrial motors	99,312	106,155
Electric railway and vehicle motors	4,444	6,607
Portable electric tools	*	54,612
Accessories and parts for motors	175,431	165,291
Electric appliances:		
Electric fans	167,913	97,002
Electric lamps:		
Metal filament	102,119	167,121
Other electric lamps	27,084	17,578
Flashlights	110,421	171,747
Searchlights and projectors	44,308	33,409
Motor-driven household devices	$100,137	$174,334
Domestic heating and cooking devices	94,188	173,082
Industrial electric furnaces and ovens	31,121	29,759
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	127,261	143,050
Signal and communication devices:		
Radio apparatus	604,769	†
Transmitting sets and parts	*	179,129
Receiving sets	*	216,119
Tubes	*	96,850
Receiving-set components	*	153,609
Receiving-set accessories	*	174,331
Telegraph apparatus	44,353	93,702
Telephone apparatus:		
Magneto telephones	16,216	6,179
Other telephones	49,681	19,166
Telephone switchboards	142,995	11,130
Other telephone equipment	455,934	229,874
Railway signals, switches and attachments	75,782	25,523
Bells, buzzers, annunciators and alarms	19,209	33,337
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	160,461	214,684
Insulating material	113,561	134,479
Metal conduit, outlet and switch boxes	57,947	105,331
Sockets, receptacles and lighting switches	132,094	160,009
Electric lighting fixtures, interior and street	108,520	120,001
Other wiring supplies and line material	80,713	141,973
Other electrical apparatus not elsewhere stated	572,864	650,007
Rubber and friction tape	*	23,569
Globes and shades for lighting fixtures	44,355	46,430
Electrical glassware except for lighting	20,627	38,115
Electrical porcelain:		
For less than 6,600 volts	121,758	72,347
For 6,600 volts and over	42,341	91,721
Carbons, carbon brushes and electrodes:		
Electrodes for electric furnaces	77,894	132,657
Other carbon products	202,342	90,744
Insulated wire and cable (iron and steel)	32,355	39,419
Copper, bare wire	235,065	140,777
Copper, insulated wire and cable	408,805	355,669
Total electrical machinery and apparatus and supplies	$7,772,053	$8,586,252

* Not separately stated prior to Jan. 1, 1926.
† Discontinued from Jan. 1, 1926.

Industrial Activity Down

Metals, Textiles and Transportation Equipment Industries Report Decrease in Activity

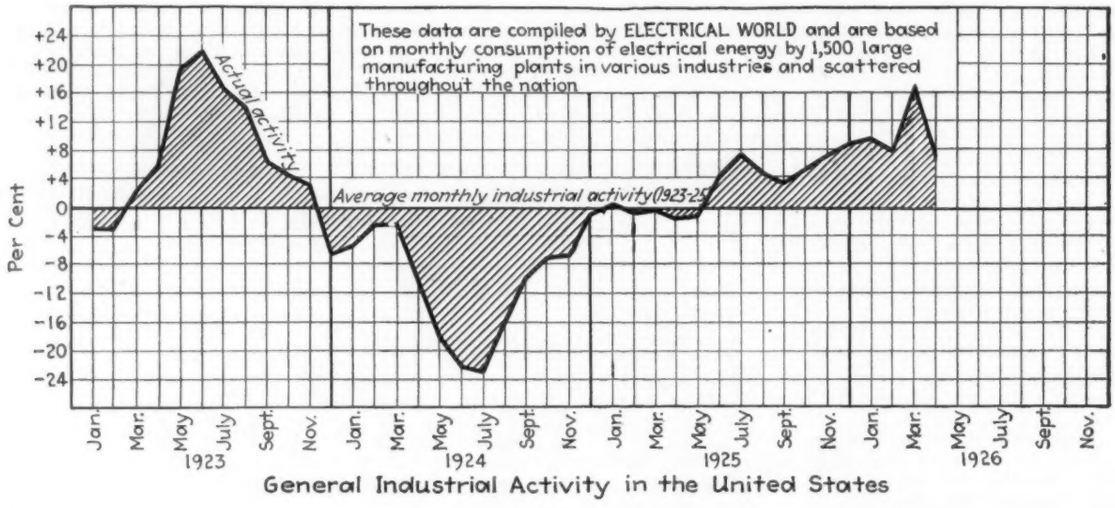
WHILE the general industrial activity of the nation during April was considerably below that of March, yet it was still above the activity reported by general industry in April of last year. The slackening in industrial activity appears to have been experienced by all of the six leading industries of the nation, with the possible exception of the stone, clay and glass industry. Such is the picture of industrial operations as outlined by the national data received by the ELECTRICAL WORLD and based upon the monthly electrical energy consumption of more than fifteen hundred large manufacturing plants in various industries and scattered throughout the nation—plants which consume more than five billion killowatt-hours per year.

The returns received by the ELECTRICAL WORLD indicate that during April general industrial activity in the nation as a whole was 6.4 per cent above the average monthly industrial activity for the past three years, this figure having been corrected for seasonal variation and weighted in accordance with the importance of the various industries. In March it was operating at 16.4 per cent and in February at 7.8 per cent above the average monthly rate, indicating, therefore, a material decrease in industrial activity during April, although industrial operations during that month were considerably better than during April of the past year, when an activity of 1.3 per cent below the average monthly was recorded.

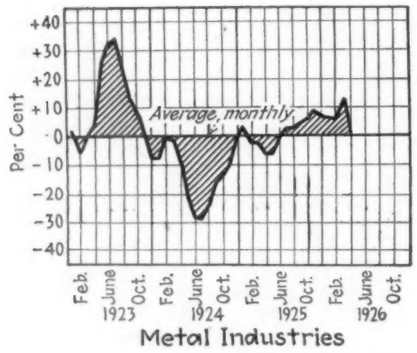
The metal industries taken as a group and for the nation as a whole reported activity during April as 0.4 per cent above the monthly average as against 12.2 per cent during March and 5.8 per cent during February. This downward trend in the activities of the metal industries appears to have been largely confined to the iron and steel branch of the industry; in fact, in New England, where non-ferrous working plants predominate, operations during April were in excess of those in March.

Textiles, leather, lumber and transportation equipment industries all reported substantial decreases in activity during April. The stone, clay and glass industry appears to have slightly increased its activities. The figures for the month of April are preliminary and are subject to later corrections.

"Electrical World" Barometer of Industrial Activity in the United States as a Whole

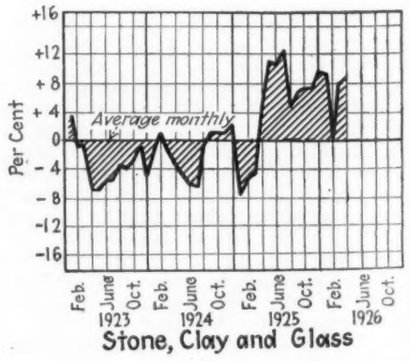


General Industrial Activity in the United States

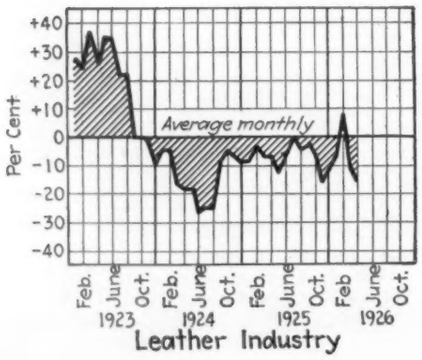


Metal Industries

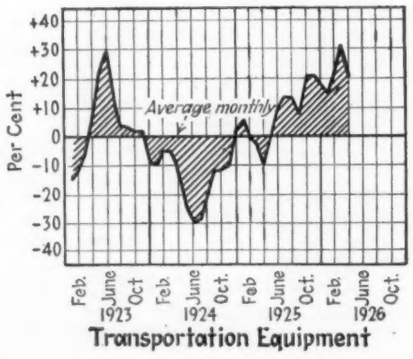
Textiles Industry



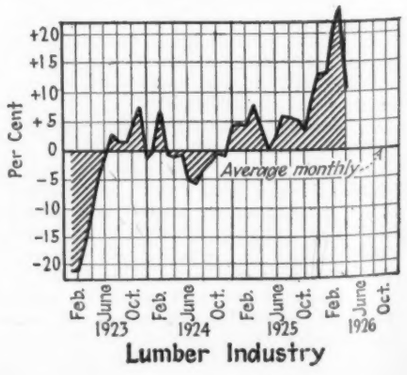
Stone, Clay and Glass



Leather Industry



Transportation Equipment



Lumber Industry

tion is the campaign for economical processes of production and the elimination of waste.

The results obtained by the railroads are an outstanding example of the benefits, not only to the corporations themselves but to the country as a whole, flowing from efficient operation. The production and distribution of electricity on a large scale and its application to the whole range of industrial, commercial and human interests, from electric locomotives and electrified steel mills down to the familiar and now indispensable household electric appliances, make for perhaps the greatest step of all in the direction of possible efficiencies in performance never before attainable.

Along with the present accumulation of wealth and its efficient application to the needs of the people is coupled a favorable financial condition, in that the supply of money at reasonable rates is adequate to carry forward all legitimate extensions of business. And, looking beyond the boundaries of our own country, the improving condition of Europe, as indicated by progress in settlement of international debts, disarmament conferences and an apparent general desire for a productive peace, should not only help business abroad but should react favorably on conditions in the United States. The present British situation can be looked on as a temporary setback, the general strike having been already settled.

After considering all these factors, the industry should be encouraged to look forward to prosperous months if business is sanely handled on a good management basis, without undue stimulation for any unwarranted boom and, on the other hand without disturbance by unnecessary fears that perhaps not every one of the favorable features may last indefinitely.

Business Conditions

MANUFACTURERS report that the volume of business compares very favorably with that of last year to date. A slight falling off has been noted in inquiries, but sales are being maintained. A contract for $575,000 worth of electrical apparatus, including three 15,000-kva. generators, three 15,000-kva. transformers and control appliances, was awarded by a New England power company, and three 18,000-hp. water turbines were also purchased for the same development. Negotiations are under way for equipment for a number of projects in other sections of the country and will result in particularly good orders if the plans materialize—which it is quite likely that they will.

A large jobber reports business as fair with a slight recession noted, but no drastic drop is anticipated. Business is said to be better in the South and on the Pacific Coast. A resumption of the good buying noted in the first quarter of the year is expected to take place later in the year. Export business is good in spots. Japan is placing many orders, quotations for a large railway electrification project in Spain have been recently submitted, and many projects are under way in Russia but are apparently awaiting financial allocation. The large electrically operated steel plant in Chile is again coming to the front in the news. Organization work for that project is under way and its consummation is extremely favorable. Plans include a hydro-electric development, and it is expected that orders will be placed anywhere in from three to six months. The United States Steel Corporation has reported a decrease of 511,959 tons in unfilled orders. A total of 3,867,976 tons of forward business was on the books of the company on April 30.

In New England power equipment continues in active demand. Motor manufacturers report a tendency for buyers to place orders for larger lots, and control appliances and switches are selling in increasing volume. Steady buying is noted in the New York district and some large orders are in view. Industrial buying is good, with the demand mainly for small apparatus. In the Southeast line materials continue in strong dmand and very satisfactory inquiries have been received for substation equipment. Activities are increasing in the St. Louis district, especially in the territory southwest and tributary to St. Louis. Inquiries are steady in that territory, and indications point to a good volume of business for the year. Distribution equipment is in active demand in the Middle West, and the volume of sales is holding up well. On the Pacific Coast several orders for power apparatus were reported, especially for transformers, motors and street-lighting equipment. Sales of pole-line construction material were particularly large in this section during April and the demand is continuing at a high rate.

Sales of Copper Large in Metal Market—Lead Price Declines

SALES of copper and lead have been in satisfactory volume despite the anxiety in industrial circles as a result of the British general strike. With the news that the general strike has been called off, followers of the market expect to see a marked improvement of metal buying in the next few days. Most sellers of copper have been openly quoting 13¾ cents delivered in the East and 14 cents in the Middle West, but concessions have been made in numerous instances. The full price was obtained in many sales, however.

Though London advanced on Tuesday, the American Smelting & Refining Company cut its price on New York lead from 7.85 cents to 7.75 cents, probably owing to insufficient business at the higher level, to a weaker market in St. Louis and to a desire to withdraw further support of the London market. Some sellers have done a very good business during the week, whereas others have not sold so much as they would have liked. Prices are about the same whether for May, June, or July shipment. Neither galvanizers nor brass makers have taken much interest in the zinc market during the week, and the prices has held steady, with only moderate sales. A fair business has been done in tin, but in general the market has been quiet, with the large premium on early deliveries of Straits continuing.

NEW YORK METAL MARKET PRICES

	May 5, 1926 Cents per Pound	May 12, 1926 Cents per Pound
Copper, electrolytic	13.825	13.90
Lead, Am. S. & R. price	7.85	7.75
Antimony	14¼	12¾
Nickel, ingot	34	35
Zinc, spot	7.10-7.15	7.125
Tin, Straits	64½	63½
Aluminum, 99 per cent	28	28

Base copper price May 12, 1926, 16¼ cents

Line Materials Continue in Strong Demand in Southeast

Business throughout the Southeast is reported satisfactory with prospects good for continued activities during the coming months. Active purchasing of line materials continues to be made by the larger central-station companies, while orders from the smaller power companies are reasonably active and municipal buying is in good volume. In fact, the heavy demand is producing rather long deliveries on creosoted pine poles, and there is a tendency on the part of some of the smaller users to shift back to Western red cedar and cypress poles, particularly in middle and south Georgia. Very satisfactory inquiries on substation equipment are reported. Merchandise campaigns by central-station companies are meeting with success. A low-priced vacuum cleaner recently placed on the market is proving a good seller.

The larger jobbers are busily estimating on new projects, and the smaller contractors are engaged in house wiring and placing good orders for wiring materials. Jobbers' sales to retailers are somewhat off as the central-station companies have entered this field very actively. Orders for white-way equipment are being received from municipalities over the territory generally, but particularly in Georgia and Alabama. Orders from Florida real estate dealers, which have assisted considerably in maintaining the activity of this line for the past year, have fallen off considerably and little business is anticipated from this class of purchaser for the next few months. The movement of fans is reported excellent in Florida, Louisiana, south Georgia and south Alabama, with the demand area widening rapidly. Prospects indicate a record season in this line.

Steady Buying in New York District—Large Orders in View

Central-station companies are buying steadily in the New York district, the total volume of sales being somewhat better than for the corresponding period last year, although no individual orders are outstanding. Many interesting developments are under way and are expected to culminate in orders at an early date. Manufacturers of switching equipment report a considerable volume of orders from holding companies for

installation on Southern properties, together with inquiries from local companies which indicate an improvement in this field. Insulators and hardware are in steady demand, and a fair amount of sales of this equipment is reported. Transformers also are in demand, although no large individual orders are reported. Industrial buying of small apparatus continues to improve, but the demand for motors and equipment in the larger sizes is light. The market for control equipment particularly is showing an improvement over recent reports. Jobbers report a slight increase in the demand for appliances, although their other lines continue inactive.

Many Orders for Power Apparatus Placed on the Pacific Coast

Many orders for power apparatus were placed on the Pacific Coast. Transformers have been in demand for shipment to the irrigating districts, a typical order being for 25 6,600-volt units, in sizes of 3 kva., 5 kva. and 7½ kva. Another transformer order placed called for four 2,500-kva., 11,000-volt units. Small motors have been in active demand, one manufacturer reporting an order for 150 machines for calculating apparatus and 100 units for oil burners. An order covering transformers and condensers amounting to about $100,000 is in immediate prospect. Power companies have purchased a fair amount of line-construction material, and an unusual conduit inquiry covered 19,000 ft. each of 3-in. and 4-in. sizes. Appliance business is good, the demand having been created by the introduction of supplementary lines cheaper than the standard units.

Sales of pole-line hardware have been in particularly good volume during April and the demand continues. The city of Seattle is in the market for 11,500 cross-arms. and a telephone company has requested bids for $20,000 worth of line material. An inquiry by an industrial firm for approximately $200,000 worth of motors and accessories is reported by manufacturers. Orders have just been placed for oil circuit breakers, switching apparatus and street-lighting equipment by the city of Seattle, and for 20 motors by a lumber company.

New England Continues to Buy Power Equipment

Interest in power equipment continues active throughout the New England district, and sales of this type of product are forging ahead. A central-station company has awarded contracts for equipment, amounting to $575,000, to be installed at Bellows Falls, Vt., including three 15,000-kva. generators, three 15,000-kva. transformers and control appliances. Three waterwheels, rated at 18,000 hp. each for operation under a 54-ft. head, were also purchased for this project. Small motor sales are steady and are increasing in volume. Perhaps one of the most encouraging features in this division of the electrical market is the tendency, reported by a number of manufacturers' representatives, to resume buying in larger lots. During the week a number of such orders were recorded, one for 150 fractional-horsepower units and a number of others for smaller lots. Control appliances and switches are receiving much attention. A prominent manufacturer reports an encouraging swing in sales during the first quarter, with May business promising to better the monthly record, the increase in volume amounting to about 20 per cent over that of last year for the first quarter.

Activities Increasing in St. Louis District—Demand Steady

A large manufacturer in the St. Louis district reports that all electrical activities are increasing in the territory southwest and tributary to St. Louis. In the petroleum fields this is especially noticeable; operators are installing electrical pumping outfits and buying electrical drilling equipment. While no very large orders have been reported inquiries are steady in all lines, and indications point to a splendid year. Manufacturers of electrical advertising equipment report a good business for the year to date, but some decrease has been noted in the last week or two. This form of advertising is said to be becoming more widely adopted. Fuses are in excellent demand, and there is a fair increase in the volume as compared with last year, with good prospects for its continuance. The demand for wire has been normal and is mainly for rubber-covered wire for building construction.

Distribution Equipment in Active Demand in Middle West

The various utility companies in the Middle West are actively engaged in rehabilitation work and in extending service connections. Several interesting orders were placed this week and included seven 20,000-kva. transformers, 1,300 direct-current watt-hour meters, 7,000 5-amp. watt-hour meters and paper cable valued at $225,000. There has been an active demand for pole-line hardware, high-tension fuse equipment, insulators and stone conduit. The volume of business is generally holding up well on a steady, even basis. Railroad reports indicate that the carriers are in a prosperous condition, and building continues active, although some labor difficulties have not yet reached a definite settlement and are retarding operations somewhat. Jobbers' sales are generally good. Several unusually hot days created a large demand for fans. Electric iron sales have been exceptionally good and most appliances are in demand. Conduit, wire and wiring devices have been especially active.

Activities of the Trade

Lighting Fixture Manufacturers to Consider New Activities

At a meeting of the National Council of Lighting Fixture Manufacturers held recently in Cleveland a plan was submitted by Granville P. Rogers, managing director, for expanding the organization activities. The plan includes a broadening of the market for the sale of lighting equipment, unification of the lighting-fixture manufacturers and allied industries to remedy some of the evils in the business and set up a code of ethics and fair trade practices, and the regulation and expansion of the future activities of the council.

Under the new activities it is planned to change the name of the organization to the Association for Artistic Decorative Lighting Equipment, create new by-laws and set up the proper machinery for carrying on the work. It is the intention of the association to supplement its publicity by establishing a yearly national exhibition, to be known as the national exhibition of the Association for Artistic Decorative Lighting Equipment.

Cleveland was selected as the place for the next national exhibition, which will be held during the latter part of January or the first part of February next. The entire plan will be presented to the industry at the June convention of the association, which will be held in some suburban resort near Chicago. H. B. Garrett, who has been connected with the work for a number of years, was appointed assistant to the managing director. The general offices of the association are now at 424 Guarantee Title Building, Cleveland, but at a later date it is planned to move into larger quarters.

Crocker-Wheeler Company Elects Three New Directors

At the annual meeting of stockholders of the Crocker-Wheeler Electric Manufacturing Company, Ampere, N. J., held on Wednesday of this week, three new directors were elected to the board. They include Stewart S. Hathaway of Hathaway & Company, Leonard S. Horner, vice-president of the Acme Wire Company, and William D. Sargent, chairman of the executive committee of the American Brake Shoe & Foundry Company.

The retiring directors who were reelected included Ernest B. Humpstone of Chisholm & Chapman, Inc.; Frank H. Jones, Edmund Lang, president of the company; Edward W. Brown of Brown & Shaw; Huntington Jackson of Huntington Jackson & Company, and Michael I. Pupin, professor of Columbia University and president of the American Institute of Electrical Engineers.

A meeting of the new board of directors will be held next week for the election of officers. It is expected that the executive organization will remain unchanged.

American Metallurgical Reports Best Quarter's Business

Electric furnace sales reported by the American Metallurgical Corporation, Boston, for the three months ended March 31, 1926, totaled double the best previous three months' business in the

company's history. To a representative of the ELECTRICAL WORLD, President K. A. Juthe stated that in that quarter twenty-four furnaces, aggregating 974 kw., were sold, with the demand ranging from 20-kw. to 85-kw. units, and covering a market in the Middle West and East. There is a slight tendency at present for deliveries to lengthen, but the company has added to its factory facilities and is still quoting from four to six weeks on the larger sizes and out-of-factory stock on small units.

Among the new installations sold are the following furnaces: Two of 60 kw. and one of 40 kw. for the Union Hardware Company, Torrington, Conn.; two 85-kw. furnaces for air superheating for the F. N. Burt Company, Buffalo; one 34-kw. air superheater for Better Packages, Inc., Shelton, Conn.; four 30-kw. pot types for the Cleveland Twist Drill Company; one 30-kw. pot type for the Ferry Cap & Set Screw Company, Cleveland; one 30-kw. pot type for aluminum, Kant Score Piston Company, Cincinnati; one 40-kw. furnace for the Thomas & Skinner Steel Products Company, Indianapolis; one 30-kw., one 40-kw. and two 20-kw. furnaces for the Chrysler Corporation, Newcastle, Ind.; two 20-kw. furnaces for the Pratt & Whitney Company, Hartford, making twelve units in this plant; one 30-kw. and one 75-kw. outfit for the Gray Telephone Pay Station Company, Hartford; one 75-kw. furnace for the Cushman Chuck Company, Hartford; one 30-kw. furnace for the American Hardware Company, New Britain, Conn., and one 30-kw. installation for the Torrington (Conn.) Manufacturing Company.

The Johns-Pratt Company, Hartford, Conn., announces that it has placed on the market a new line of "Noark" standardized universal meter-service switches for single-phase or direct current, 110 volts, 30-amp. size, using plug fuses.

The States Company, Hartford, Conn., announces that it has now added to its line of meter-testing tables a six-meter position group table.

Curtis Lighting, Inc., 1119 West Jackson Boulevard, Chicago, is now offering a new color-ray equipment No. 55 at one-half the former prices.

The Waters Genter Company, 213 North Second Street, Minneapolis, announces that it has placed on the market a household size of its "Toastmaster" automatic electric toaster.

Schweitzer & Conrad, Inc., 4421 Ravenswood Avenue, Chicago, manufacturer of high-voltage protective and switching equipment, announces that its new pantograph multiple-pole air-break switch, described in the April 25, 1925, issue of the ELECTRICAL WORLD, is now available in a 154,000-volt unit.

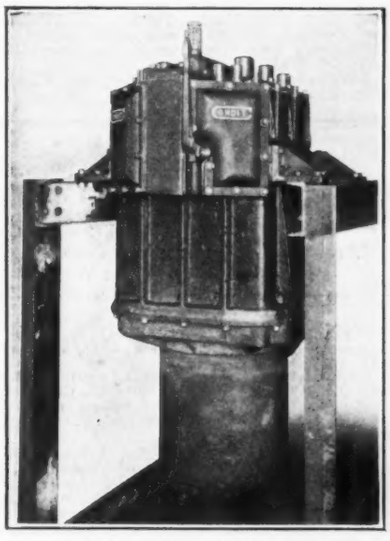
The American Electric Motors, Inc., 57 Erie Street, Milwaukee, manufacturer of motors, grinders, buffers, etc., has been completely reorganized. The capitalization has been increased $233,000, and the company has purchased a tract of land at Cedarburg, Wis., a short distance from Milwaukee, where a new plant will be erected, the initial unit to have 30,000 sq.ft. of floor space. It is expected that this plant will be ready by Oct. 1. The officers of the new organization are: C. L. Daun, president and chief engineer; John F. Nieman, vice-president, and P. C. Winner, secretary and treasurer.

Fairbanks, Morse & Company, Inc., 900 South Wabash Avenue, Chicago, has developed a grease-tube method of lubricating ball-bearing motors. The proper grease is furnished in collapsible tubes, each containing just enough grease for a motor's annual requirements. Four sizes of tubes are available for the corresponding sizes of bearings. The company states that this system insures the use of the correct quality of grease and that the slight cost of the tubes is usually offset by the elimination of waste in the use of grease.

New Equipment Available

Oil Circuit Breaker

A three-pole, single-throw, 600-amp., 15,000 volt, manually operated manhole oil circuit breaker of particularly rugged construction has been designed by the Condit Electrical Manufacturing Corporation, Boston. The interrupting capacity of this breaker is 6,000 amp. at 15,000 volts. The breaker is automatic, has resilient tanks, and is of extra-heavy steel construction. It is provided with an expansion chamber for automatic operation of the breaker when submerged.



TYPE M-21 MANHOLE OIL CIRCUIT BREAKER WITH EXTRA-HEAVY STEEL CONSTRUCTION

High-Voltage Direct-Current Indicating Instrument

A type "SX" indicating instrument suitable for use on direct-current circuits of 4,000 volts above ground has been developed by the Westinghouse Electric & Manufacturing Company. In designing this new line of instruments the external appearance was kept identical with other standard "SX" instruments. In the high-voltage instruments the steel base, on which the meter element is mounted in standard instruments, has been replaced by an insulating base made from a thick piece of micarta. By this construction of insulation a test voltage of over 9,000 has been obtained. To secure protection against flashover between the meter element and the case a cylinder of micarta has been added just inside the case to act as a shield. The puncture voltage of this shield is, therefore, added to the voltage necessary to break down any air gap between meter element and case.

In standard "SX" instruments the dial is nearly as large as the case itself. This leaves a small amount of clearance between element and case, protection being provided by an insulating ring. Sufficient clearance for high-voltage service has been obtained in the new design by decreasing the diameter of the dial so as to allow nearly a ½-in. air gap between the edge of the dial and the nearest part of the grounded metal case. This air gap is in addition to the insulation secured from the micarta cylinder. The use of the new instrument is recommended on all circuits where the maximum voltage may exceed 750 volts.

Pothead

A 75-kv. pothead furnished with a standard cap-nut terminal has been developed by the G. & W. Electric Specialty Company, 7776 Dante Avenue, Chicago. Among the advantages claimed for this unit are ample length of porcelain to give sufficient factor of safety on dry and wet flashover, ample thickness of porcelain to make the puncture voltage higher than flashover, means for taking care of the dielectric stress at the end of the lead sheath, prevention of corona at the external terminal, a positive seal at top and bottom of pothead against entrance of moisture and leakage of compound, convenient means for filling with compound or oil and sufficient mechanical strength to withstand mechanical strains.

Indicating Lamp Receptable

A new indicating lamp receptacle that combines the functions of receptacle and resistor has been placed on the market by the General Electric Company. The unit is suitable for use on switchboard panels from ⅛ in. to 2½ in. thick and on circuits operated at from 24 volts to 280 volts. The principal advantage of this combined resistor-receptacle is that it allows the supervisory connection of indicating lamps without incurring the possibility of inadvertently operating a breaker if a lamp or receptacle has become short-circuited. An additional advantage, especially on truck panels, is the elimination of fuses. The lamp used with these resistor-receptacles is rated at 18 volts, 0.11 amp. For 650-volt service a standard 140-volt resistor-receptacle may be used with an additional separate 5,000-ohm. cage-type resistor, the resistor-receptacle being connected to the ground end of the circuit.

New Trade Literature

SWITCHES, RECEPTACLES, PLUGS, ETC.—Harvey Hubbell, Inc., Bridgeport, Conn., is distributing five leaflets covering the Hubbell porcelain receptacles, shallow flush toggle switches, flush locking toggle switches, etc., for insertion in its general catalog.

ELECTRIC HOUSEKEEPING APPLIANCES.—The Graybar Electric Company, 100 East Forty-second Street, New York City, has issued a catalog covering the Graybar housekeeping appliances, including electric washers, vacuum cleaners, ironers, ranges, etc.

SAFETY SWITCHES. — The Palmer Electric & Manufacturing Company, 175 Fifth Street, Cambridge, Mass., is distributing a pamphlet describing its complete line of classification "AA" switches for both alternating current and direct current.

TREE TRIMMERS.—The Bartlett Manufacturing Company, 428 East Lafayette Avenue, Detroit, is distributing two leaflets describing its insulated tree trimmers for use around high-voltage lines, telephone and telegraph tree trimmers and its two-hand pruner (No. 777).

FLEXIBLE CORD.—The Simplex Wire & Cable Company, 201 Devonshire Street, Boston, has issued a leaflet describing its "Tirex SJ" rubber-sheathed cord for table and floor lamps, washing machines, vacuum cleaners, office equipment, extension desk fans, etc.

ELECTRIC RANGES AND APPLIANCES.—A new catalog has been issued by the A. J. Lindemann & Hoverson Company, Milwaukee, covering the "L. & H." electric ranges and appliances, including hot plates, table stoves, waffle irons, testing ovens, flatirons, electric heaters, etc.

CONTROL SWITCH.—A folder issued by the Federal Gauge Company, 564 West Adams Street, Chicago, describes and illustrates its No. 848 "Mercoid" control (industrial type) switch. It contains an illustration showing the details of construction and drawings of a few applications of the device. Tables included in the folder show the temperature or pressure ranges and differentials for both the pressure controls and the temperature controls.

WATER TESTER.—Bulletin No. 1,125 issued by James G. Biddle, 1211 Arch Street, Philadelphia, describes and illustrates the "Dionic" water tester, portable, direct-reading instrument for testing condenser leakage and boiler water. Other practical applications of the water treater are also described.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency is desired in Hull, England (No. 20,155), for electric appliances for barber shop.

Sole agency is desired in Amsterdam, Netherlands (No. 20,142), for electric household appliances and radio sets and parts. Purchase and agency is desired (No. 20,141) for potato-peeling machines.

An agency is desired in Paris, France (No. 20,143), for electric household appliances and electric refrigerating apparatus.

Purchase is desired in Leipzig, Germany (No. 20,144), of electric household appliances; also of electric mine elevator, and of centrifugal pumps for mines (No. 20,126).

Purchase is desired in Montevideo, Uruguay (No. 20,140), of radio broadcasting station.

An agency is desired in Adelaide, Australia (No. 20,091), for radio sets and parts.

An agency is desired in Geneva, Switzerland (No. 20,145), for radio sets and parts.

Purchase or agency is desired in Warsaw, Poland (No. 20,181), for radio sets and parts.

Purchase is desired in Sydney, Australia (No. 20,098), of vacuum cleaners.

Purchase is desired in Berlin, Germany (No. 20,139), of drawn zinc cups for batteries.

Purchase is desired in Melbourne, Australia (No. 20,130), of caustic soda cells, renewals.

Purchase is desired in Lisbon, Portugal (No. 20,146), of wireless towers.

An agency is desired in Madrid, Spain (No. 20,124), for baking machinery and equipment, especially electric ovens.

An agency is desired in Montreal, Canada (20,125), for mining machinery and equipment, paper and pulp machinery and equipment.

An agency is desired in Munich, Germany (No. 20,239), for electrical apparatus for use in hospitals, cafés, restaurants and hotels.

Purchase is desired in Pietermaritzburg, South Africa (No. 20,271), of electrical dishwashing machines.

Purchase and agency is desired in Amsterdam, Netherlands (No. 20,257), for electric fire-alarms, bells, clocks and appliances, electric, hydraulic and hand lift elevators.

Purchase and agency is desired in Brussels, Belgium (No. 20,351), for electrical goods.

An agency is desired in Barranquilla, Colombia (No. 20,352), for electrical goods.

Purchase and agency is desired in Ottawa, Canada (No. 20,345), for electrical novelties, lamps, hot plates, curling irons, marcel wavers, etc. Purchase is also desired of electric furnaces for dental vulcanizing work.

An agency is desired in Paris, France (No. 20,326), for electric household appliances, including sewing machines, vacuum cleaners and washing machines.

Purchase and agency is desired in Florence, Italy (No. 20,269), for radio sets and parts.

An agency is desired in Geneva, Switzerland (No. 20,287), for lighting and signaling devices for railways and cables for railways; also for insulating specialties (No. 20,232).

Purchase is desired in Toronto, Canada (No. 20,305), of radio parts.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

OAKLAND, ME.—Plans are under way by the Central Maine Power Company, Augusta, for the erection of a transmission line from Augusta to Oakland, a distance of about 17 miles.

BROCKTON, MASS.—The Edison Electric Illuminating Company of Brockton has applied to the Public Utilities Commission for permission to erect a high-tension transmission line from Brockton to Pembroke. The plans include the construction of two substations, one in Abington and one in Whitman. The cost of the project is estimated at $150,000.

SOMERVILLE, MASS.—The Agar Manufacturing Corporation, Medford, plans to install electric power equipment in its proposed local box manufacturing plant, to cast about $200,000.

HARTFORD, CONN. — Bids will be received by the Board of Contract and Supply, Municipal Building, until May 18, for 11,000 ft. No. 7 wire cable, and 7,000 ft. No. 10 wire cable.

Middle Atlantic States

AVON, N. Y. — The local equipment storage and distributing plant of the Niagara, Lockport & Ontario Power Company, Buffalo, was recently damage by fire, causing a loss of about $17,000.

KINGS PARK, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until May 26 for air compressors, etc., and for two electric generators for the Kings Park State Hospital.

KINGS PARK, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until May 26 for heating, sanitary and electric work, service connections for the Veterans' Memorial Hospital, Kings Park State Hospital.

MIDDLETOWN, N. Y.—The consolidation of the Rockland Light & Power Company, Nyack, the Orange County Public Service Company, Inc., and the Catskill Power Corporation of Middletown, has been authorized by the Public Service Commission, under the name of the Rockland Light & Power Company. The new corporation has also been authorized to issue $2,500,000 in new capital stock, the proceeds to be used exclusively toward new construction, estimated to cost $3,268,763.

NEW YORK, N. Y.—Plans have been filed by the New York Edison Company for the erection of a substation, at 108 East Seventh Street, to cost $40,000. William Whitehill, 709 Sixth Avenue, is architect.

NEW YORK, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 18 for delivering to the Navy Yard, New York, motor generators, control panels, etc.

ROCHESTER, N. Y.—Bids are being received by the Rochester Realty Company, care Dow, Harlow & Kimball, architects, 184 Boylston Street, Boston, for store, office and apartment building, including power plant, to be erected at Hanson, Wakefield and Autumn Streets, Rochester, to cost about $150,000.

STATEN ISLAND, N. Y.—Bids will be received by the Superintendent of Lighthouses, Staten Island, N. Y., until May 24 for eleven radio beacon tube type transmitting sets.

SYRACUSE, N. Y.—The Board of Contract and Supply, is considering the installation of an improved electric fire-alarm system.

YONKERS, N. Y.—Plans have been filed by the Yonkers Electric Light & Power Company for the construction of an outdoor substation at Bennett Place and Dunwoodie Avenue, to cost about $50,000.

BELLEVILLE, N. J.—The Public Service Electric & Gas Company, Newark, plans to erect a transmission line through the Greylock district.

PHILADELPHIA, PA. — Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 18, for 200 storage batteries for the local navy yard (Schedule 5380).

PHILADELPHIA, PA.—The Philadelphia Electric Company plans to build a substation, at 52-54 North Sixth Street. John T. Windrim, Commonwealth Building, is architect.

SHARON, PA. — The Mercer County Light, Heat & Power Company, Greenville, plans to build a substation for switching service in this section and transmission line across the Shenango River.

WILMINGTON, DEL.—The Wilmington & Philadelphia Traction Company plans to build a new switchboard gallery in its power station at the foot of Buena Vista Street.

BALTIMORE, MD.—Bids will be received by the Board of Awards, City Hall, until May 19, for electric substation equipment, for the Hillen pumping station. V. Bernard Siems is water engineer.

BALTIMORE, MD. — Plans are being prepared by the Consolidated Gas, Electric Light & Power Company for the construction of an equipment storage and distributing plant, on East Monument Street, to cost about $250,000.

DAMASCUS, MD.—The Damascus Power & Light Company is planning to erect a distribution line from Damascus to Ridgeville, and also to build a line from Claggettsville to Kempton, a distance of 3 miles.

RICHMOND, VA.—Plans have been approved by the directors of the Virginia Power Company for extensions of its transmission lines from Roanoke Rapids to Tarboro in North Carolina, and from Fredericksburg to Quantico in Virginia, and also for extending its lines to Elizabeth City, N. C., in case the municipal electric plant is taken over there.

WASHINGTON, D. C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 26, for motor-generator sets, switchboards and accessories, at the naval operating base (submarine base), Pearl Harbor, Hawaii. For details see Searchlight Section.

North Central States

DETROIT, MICH.—The budget of the Public Lighting Commission for the fiscal year calls for an expenditure of $772,581, of which $350,000 will be used for the installation of new street lamps throughout the city.

HAMTRAMCK, MICH.—Dodge Brothers, Inc., 7900 Joseph Campau Avenue, Detroit, plans to install electric power equipment in a proposed addition at its local plant, to cost about $200,000.

LANSING, MICH.—Plans are under consideration by the Municipal Light & Power

Bureau for extensions to the municipal electric light and power plant, to cost about $850,000.

DAYTON, OHIO.—The Delco Light Company plans to install electric power equipment in the proposed additions to its plant, to cost about $2,000,000.

PAINESVILLE, OHIO.—The Cleveland (Ohio) Electric Illuminating Company, is negotiating for the purchase of the municipal electric plant. If acquired it will extend its transmission lines here for local service.

YELLOW SPRINGS, OHIO—Bids will be received by the Board of Trustees of Public Affairs until May 20 for electric light poles as follows: Forty white cedar poles, 30 ft. long; twelve white cedar poles, 35 ft. long; forty red cedar poles, 30 ft. long, and twelve red cedar poles, 35 ft. long.

ASHLAND, KY.—The American Rolling Mill Company, Middletown, Ohio, plans to install electric power equipment in the proposed additions to its local plant to cost about $250,000.

MOREHEAD, KY.—The Kentucky Power Company, Augusta, which has acquired the municipal electric plant, plans to build a 2,000-kw. electric plant.

OWENSBORO, KY.—The City Council is considering rebuilding the switchboard in the municipal electric plant.

JEFFERSONVILLE, IND. — The Interstate Public Service Company, Indianapolis, has acquired a site in the vicinity of the Utica Pike, where it contemplates building a steam-electric power plant, to cost about $350,000.

CHICAGO, ILL.—Plans have been filed by the Chicago Surface Lines, Illinois Merchants Bank Building, for a substation at 5329 Grimm Avenue, to cost about $21,000.

NORTH CHICAGO, ILL.—Bids will be received by the United States Veterans' Bureau, Room 791, Arlington Building, Washington, D. C., until June 8, for construction of buildings and utilities at the United States Veterans' Hospital No. 105, North Chicago. Separate bids to be submitted for building construction, plumbing, heating, electrical work and elevators.

WAUKEGAN, ILL. — Johns-Manville, Inc., Madison Avenue and Forty-first Street, New York, plans to install electric power equipment in connection with the rebuilding of its local asbestos products plant, recently damaged by fire, with a loss of about $300,000.

AMERY, WIS. — The properties of the Wisconsin Hydro-Electric Company, Amery, and the Municipal Power Corporation, Mason, serving together forty towns and villages in Northern Wisconsin, has been acquired by the W. B. Foshay Company, Minneapolis. It is proposed to interconnect these properties, which will include a tie-up with the new 2,000-hp. hydro-electric plant at Spooner, to be built by the Wisconsin Hydro-Electric Company.

GREEN BAY, WIS.—The directors of the Wisconsin Public Service Corporation have decided upon the erection of rural line extensions, totaling 182 miles during 1926, covering the following districts: Green Bay, 25½ miles; Peninsular, 39½ miles; Manitowoc and Oslo, 42½ miles; Brillon and Chilton, 36½ miles; Northern Power Company, 29¾ miles, and Oconto, 8½ miles.

MONROE, WIS. — The City Council is considering a proposal submitted by the Wisconsin Power & Light Company for the installation of an ornamental lighting system in the business district.

CABOOL, MO.—The Missouri Power & Development Company, Willow Springs, has applied for permission to erect a transmission line from Cabool to Mountain Grove along the State Highway. The company holds franchises for lighting at Willow Springs, Cabool, Houston, Mountain View, Winona, Birch Tree and Mountain Grove.

WASHBURN, N. D.—Contract has been awarded by the Otter Tail Power Company, Fergus Falls, Minn., to Siems, Helmers & Schaffner, Inc., St. Paul, for the construction of a 12,000-hp. steam power plant at Washburn. C. W. Welch is chief engineer.

Southern States

RALEIGH, N. C.—Preparations are being made by the Carolina Power & Light Company for the construction of a hydro-electric plant on the Pigeon River, near Hartford, Tenn. The plans provide for an initial installation of 50,000 hp., with an ultimate development of 100,000 hp. The total cost of the project is estimated at $10,000,000.

ATLANTA, GA. — A permit has been granted the Georgia Railway & Power Company to construct a new substation in Atlanta, to cost about $70,000.

COCHRANE, GA.—The South Georgia Power Company, Albany, which has acquired the municipal electric plant, plans extensions in its transmission lines in this vicinity.

FAYETTEVILLE, GA. — The Georgia Railway & Power Company, Atlanta, which has acquired the municipal electric distribution system (uncompleted), plans to complete the system and extend its high-tension transmission line here.

APALACHICOLA, FLA.—The installation of an ornamental lighting system in the business section, to cost about $7,300, is under consideration by the City Commissioners.

MARIANNA, FLA.—Bonds to the amount of $100,000 have been sold, of which $36,000 will be used for water and light extensions.

SARASOTA, FLA. — The City Council will soon take bids for electric generator, engine and auxiliary equipment for a power plant for waterworks service.

KINGSPORT, TENN.—Bids will soon be asked by the Holliston Mills of Tennessee, Inc., for electric and steam power equipment for its proposed local textile mill. The cost of the entire project is estimated at $350,000. Charles E. Leonard, Kingsport, is engineer.

FOREST, MISS.—Plans are under way by A. R. Williams, Yazoo City, and associates, for the construction of an electric plant for local service.

BLYTHEVILLE, ARK.—The Arkansas-Missouri Power Company, plans to install electric power equipment in its proposed local ice-manufacturing plant and for ice plants at Walnut Ridge and Monette, Ark.

EUNICE, LA.—The Gulf Public Service Company, a subsidiary of the General Public Utilities Company, managed by Day & Zimmermann, Inc., 1600 Walnut Street, Philadelphia, which has acquired new properties in Louisiana plans the erection of a number of high-tension lines to interconnect a number of communities in the southern section of the state, including a 35-mile line between Jeanerette and Patterson, which will serve a number of communities along the line. A new generating unit will be installed in the plant at Eunice. In northern Louisiana the construction of a transmission line has been authorized between Oil City and Vivian, and also a line from Vivian to serve a number of towns along the Texas & Pacific Railway, north of Shreveport. The generating plant at Vivian will be enlarged.

McDONOGHVILLE, LA.—The Texas & Pacific Railroad Company, Dallas, Tex., plans to install electric power equipment at its proposed terminal and shops in the Gouldsboro district, to cost about $750,000.

OKLAHOMA CITY, OKLA.—Plans are being considered by the Oklahoma Gas & Electric Company for the installation of a 27,500-hp. generating unit at its Horseshoe Lake plant.

AMARILLO, TEX.—Plans are being prepared by the Southwestern Public Service Company, managed by Day & Zimmermann, Inc., 1600 Walnut Street, Philadelphia, for the installation of a 5,000-kw. steam turbo-generator unit at its local plant, and the erection of a 54-mile transmission line from Amarillo to Panhandle and Pampa.

DALLAS, TEX. — A permit has been granted by the State Board of Water Engineers to the Syndicate Power Company, Dallas, for the construction of six dams on the Colorado River, between Austin and San Saba. The plans provide for a total development of 122,700 hp. at a cost of about $20,000,000.

GALVESTON, TEX.—The erection of a 33,000-volt transmission line to Galvez Mill is under consideration by the Galveston Electric Company.

MABANK, TEX.—Plans are under way by the Southwestern Public Service Company, a subsidiary of the General Public Utilities Company, managed by Day & Zimmermann, Inc., 1600 Walnut Street, Philadelphia, for the construction of an electric power plant and ice factory in Mabank. The company has secured contracts with the cities of Kemp and Mabank for sale of power for pumping water, and electric lines will be erected at once to furnish the service.

OLMITO, TEX.—Plans are under way by A. Parker, Brownsville, for developing a townsite here, covering about 1,000 acres, including a bridge across the Resaca, waterworks, lighting plant, etc. The cost is estimated at $600,000. W. H. Ampher, La Feria is engineer.

Pacific and Mountain States

CHELAN, WASH.—Application has been made to the Federal Power Commission by the Great Northern Railway Company, St. Paul, Minn., for a license to erect a transmission line in Chelan and King Counties across Snoqualmie and Wenatchee National Forest, Washington.

SEATTLE, WASH. — The Municipal Lighting Department plans to install an improved lighting system on Cedar Street and connecting thoroughfares.

LONG BEACH, CAL.—Plans have been filed by the Southern California Edison Company, Los Angeles, for the construction of a substation at 1325 Locust Avenue, to cost about $25,000.

LOS ANGELES, CAL.—The City Council has approved an ordinance for the installation of ornamental lamps on Eighth and Ninth Streets, between Cloverdale Avenue and Ridgley Drive, using concrete standards.

LOS ANGELES, CAL. — The County Supervisors have authorized the installation of ornamental lamps on San Gabriel Boulevard, between Winchester Street and the South Pacific Railway.

RIVERSIDE, CAL.—The City Trustees are considering the installation of ornamental lamps on New Magnolia Avenue, using concrete standards.

ROSEVILLE, CAL.—The Pacific Fruit Express Company, San Francisco, plans to install electric power equipment in the proposed addition to its car shops and precooling plant, to cost about $1,000,000.

SACRAMENTO, CAL. — Permission has been granted the El Dorado Power Company for the construction of a hydro-electric power plant on the south fork of the American River, to develop 24,850 hp. The cost is estimated at $3,000,000, with transmission system.

SAN BERNARDINO, CAL.—The Southern Sierras Power Company, Riverside, plans to build an addition to its local electric power plant on Chestnut Street, to cost about $100,000.

SAN DIEGO, CAL.—The City Council has authorized the installation of ornamental lamps on portions of Twelfth and Thirteenth Streets, Imperial and National Avenues, covering about 11 blocks.

SANTA ANA, CAL.—The City Trustees have authorized plans for the installation of ornamental lamps on South Main Street.

TEHAMA, CAL.—Plans are being prepared by P. B. Cross, 550 Montgomery Street, San Francisco, for a power development in Tehama County, to cost about $1,500,000. W. Van Norden, Mills Building, San Francisco, is engineer.

VENTURA, CAL. — The City Trustees are considering a petition for the installation of ornamental lamps on Santa Clara Street. C. W. Pierce is city engineer.

FLAGSTAFF, ARIZ. — The Flagstaff Electric Light Company plans extensions in its power plant, including the installation of additional equipment.

PUEBLO, COLO.—The Colorado Fuel & Iron Company plans to install electric power equipment in the proposed addition to its steel mill, to cost about $1,000,000.

ARTESIA, N. M.—The Southwestern Public Service Company, managed by Day & Zimmermann, Inc., 1,600 Walnut Street, Philadelphia, contemplates the erection of a transmission line from Artesia to Dayton to serve electricity there.

CARLSBAD, N. M.—Plans are being considered by the Southwestern Public Service Company, managed by Day & Zimmermann, Inc., 1,600 Walnut Street, Philadelphia, for the installation of additional generating equipment at its local electric plant.

Canada

CALGARY, ALTA.—Bids, it is understood, will soon be asked by the Calgary Power Company for the erection of a transmission line between Calgary and Red Deer, to cost about $300,000.

QUEBEC, QUE. — Authority has been granted the Shawinigan Water & Power Company, to erect a transmission line between this city and the Isle Maligne.

ST. PACOME, QUE.—The Kamouraska Hydro-Electric Company has petitioned the Public Service Commission for permission to erect a transmission line, 50 miles long, to connect St. Pacome and Riviere du Loup. Electricity would be secured from the Electric Power Company of Montmagny.

Electrical Patents

Announced by U. S. Patent Office

(Issued April 13, 1926)

1,580,477. REACTION SYNCHRONOUS MOTOR; C. L. Fortescue, Pittsburgh, Pa. App. filed Jan. 5, 1923. Self-starting and capable of developing a high torque at synchronous speed.

1,580,495. ELECTRICAL APPARATUS; L. S. Keilholtz, Dayton, Ohio. App. filed Jan. 24, 1924. Control of generator-storage-battery system.

1,580,506. ELECTRICAL APPARATUS; R. L. Lee, Dayton, Ohio. App. filed Dec. 31, 1923. System of electrical distribution and control for one or more power-translating devices, using a transformer to impress upon said devices a voltage different from that of the supply-line voltage when desired.

1,580,511. ELECTRIC FURNACE; G. M. Little, Pittsburgh, Pa. App. filed March 24, 1924. Resistance type.

1,580,516. LIGHTNING ARRESTER; R. E. Marbury, Wilkinsburg, Pa. App. filed April 7, 1922. Employed in conjunction with condensers to protect them from abnormal voltages.

1,580,523. MAXIMUM-DEMAND METER; W. G. Mylius, Wilkinsburg, Pa. App. filed Jan. 24, 1921. Indicating type.

1,580,530. DETACHABLE COLLECTOR RINGS; R. E. Rambo, Wilkinsburg, Pa. App. filed July 11, 1924. Slip rings of the shrunk-on type mounted on a detachable supporting member and particularly adapted for railway motor service.

1,580,532. ELECTRIC FURNACE RESISTOR-SUPPORTING MEANS; T. A. Reid, Wilkinsburg, Pa. App. filed Feb. 23, 1922.

1,580,554. APPARATUS FOR TRANSFORMING ELECTRICAL ENERGY; J. E. Calverley and W. E. Highfield, Preston, England. App. filed March 26, 1920. For transforming alternating-current energy into direct-current energy and vice versa, or to transform direct current of one voltage to direct current of another voltage. One or more transformers are employed whose one set of windings is so interconnected as to provide a closed circuit in which the total electromotive force at any moment is zero if the windings are operating as a secondary to the transformer or transformers, and the said closed circuit is connected to commutating gear in substantially the same manner as the winding of a Gramme ring armature is connected to its commutator. Suitable for operation with high voltages, such for example as 100,000.

1,580,587. MOUNTING FOR ELECTRIC MOTORS; A. P. Daniel, Springfield, Ohio. App. filed Jan. 31, 1922. Used to drive the revoluble grinding member of a grinding or attrition mill.

1,580,595. ELECTRIC BELL; A. C. Gaynor, and E. G. Gaynor, Stratford, Conn. App. filed April 20, 1923. Striking or ringing device for bells.

1,580,596. STORAGE BATTERY; D. Grill, Roanoke, Va. App. filed Feb. 14, 1925. Manner of mounting the plate groups upon the cover and the links upon the posts of such plate groups.

1,580,629. MOTOR-STARTING APPARATUS; C. D. Ainsworth, Wollaston, Mass. App. filed Nov. 6, 1923. Means to govern the closing of the running switch automatically so that it cannot be closed until the motor has been brought up to about its normal running speed and the starting current has dropped to some predetermined low value.

1,580,639. ELECTRIC CONNECTOR; J. Berg, Chicago, Ill. App. filed Nov. 1, 1920. Plug-and-socket type.

1,580,663. ELECTRIC WALL SWITCH; S. S. Grady, Newtonville, Mass. App. filed March 2, 1923. Toggle type.

1,580,682. ELECTRIC MOTOR; H. K. Sandell, Chicago, Ill. App. filed Aug. 17, 1922. Adapted for use in musical machines employing stringed instruments of the viol class, where the motor may serve to operate the bow shafts at varying speeds.

1,580,704. PORTABLE RADIATOR; T. H. Willson, Seattle, Wash. App. filed Jan. 13, 1925. Hot-water type.

1,580,715. CIRCUIT CONTROLLER; F. T. Fereday, Clinton Heights, N. Y. App. filed Oct. 14, 1922. The resistance of which at the points of contact in the circuit will remain at a uniform and minimum value for an indefinite period of time; possessing permanence of calibration.

1,580,750. BATTERY-ELEMENT SUSPENSION MEANS; M. L. Martus, Woodbury, Conn., and J. G. Ross and E. H. Becker, Waterbury, Conn. App. filed March 11, 1925. For primary batteries.

1,580,768. ELECTRICAL MEASURING INSTRUMENT; V. H. Todd, Newark, N. J. App. filed Feb. 26, 1921. Ammeters for use in connection with storage batteries, automobiles and similar service.

1,580,794. BRAZER; H. W. Seltzer, Sawtelle, Cal. App. filed Dec. 22, 1921. Which includes electrodes adapted to have direct contact with the metal to be brazed.

1,580,797. ELECTRIC HEATER; C. C. Abbott, Pittsfield, Mass. App. filed Nov. 26, 1924. For oil wells.

1,580,800. SYNCHRONIZING SYSTEM; J. Auchincloss, Scotia, N. Y. App. filed May 24, 1924. Where a source of electric current is required to be synchronized with a power bus or line arranged to be supplied with current from a plurality of sources and has for its object the provision of means for insuring that a source is not synchronized with one bus or line and then inadvertently connected to another bus or line.

1,580,802. ELECTRIC REGULATING SYSTEM; T. F. Barton, Schenectady, N. Y. App. filed June 13, 1924. Voltage-regulating system for three-wire direct-current systems.

1,580,810. DYNAMO-ELECTRIC MACHINE; J. L. Burnham, Schenectady, N. Y. App. filed Aug. 24, 1922. With protection from the destructive action of a flash-over.

1,580,811. STATIONARY INDUCTION APPARATUS; L. H. Burnham, Pittsfield, Mass. App. filed Oct. 23, 1920. Means for ventilating air-blast transformers using baffles to break up the stagnant and surface-bound portions of the air columns therein, thereby avoiding local hot spots in the winding but preserving the straight-line character of the air passages.

1,580,825. HIGH-POTENTIAL TERMINAL SEPARATOR; M. J. Griffith, Jamaica, N. Y. App. filed July 2, 1921.

1,580,848. ELECTRIC MOTOR AND CONTROL SYSTEM THEREFOR; P. A. Newman, Woodhaven, N. Y. App. filed June 30, 1921. A motor that may be shifted during full operation from one source of current to another without decreasing its speed or mechanical output.

1,580,849. ELECTRICAL CONNECTION; B. A. Olson, Maywood, Ill. App. filed Sept. 22, 1923. Attachment plug.

1,580,996. FUSE PLUG; L. D. Christie, Trumbull, Conn. App. filed Aug. 15, 1924.

(Issued April 20, 1926)

1,581,104. FILLING PLUG FOR STORAGE-BATTERY COVERS; J. N. Davis, Denver, Col. App. filed April 20, 1925. To replace the usual cap form of plug; device is provided with indicating means by which the level of the battery solution above the tops of the plates in the jar can be ascertained at all times without the necessity of removing the plug.

1,581,117. PERIODIC ROTARY AND CAM SWITCH; H. L. Haynes, Lakewood, Ohio. App. filed April 27, 1925. For controlling the circuit to intermittently illuminated electric signs which will cause contact to be successively made with different portions of a rotatable member to insure even wear and good contact.

1,581,143. MOTOR CONTROLLER; E. W. Seeger, Milwaukee, Wis. App. filed March 16, 1926. Having improved means for insuring against immediate response of the accelerating switches upon establishment of power connections for the motor.

1,581,154. TRANSMISSION LINE; A. O. Austin, Barberton, Ohio. App. filed Dec. 6, 1920. To provide means or arrangement of apparatus to counteract resonance effects. The energy represented by these small increments is absorbed so that the magnitude of the oscillation in the system is kept down or damped out.

1,581,192. ELECTRIC RELAY; B. E. Getchell, Plainville, Conn. App. filed Oct. 25, 1924. Having a heater strip with its opposite ends bent over anchorage members, a thermostatic switch with a bimetallic member secured to said heater strip, end caps having introverted portions with non-circular recesses, and means for preventing rotation of the caps. Having the general appearance of a cartridge fuse.

1,581,203. AIRCRAFT BATTERY; J. L. Haight, Jr., Fort Worth, Tex. App. filed Sept. 4, 1925. Storage battery and mounting therefor.

1,581,205. PROCESS OF PREVENTING THE PERSISTENCE OF CHAIN FORMATIONS IN AN ELECTRIC DEHYDRATOR FOR OIL EMULSIONS; F. W. Harris, Los Angeles, Cal. App. filed Feb. 11, 1925.

1,581,209. ELECTRICAL SWITCH MECHANISM; A. J. Heitz, Vincennes, Ind. App. filed Nov. 13, 1924. For use in connection with an electric lamp fixture employed with lamps in multiple.

1,581,233. THERMOSTATICALLY CONTROLLED SOCKET SWITCH; R. D. Smith, Scarsdale, N. Y. App. filed Dec. 3, 1920. Pull-chain control; employing a controlling thermostat to delay automatically the circuit-breaking action when the switch has been manually actuated to extinguish the light.

1,581,259. ELECTRIC HEATER; G. A. Wiechert, Howard Beach, N. Y., and J. E. Judd, New York, N. Y. App. filed Jan. 29, 1923. Adapted for service in connection with the preparation of investitures for dental castings.

1,581,260. SAFETY TEMPERATURE CONTROL; C. Wilhjelm, Philadelphia, Pa. App. filed Sept. 18, 1922. Automatic temperature alarms usable in connection with ovens, boilers, distilling apparatus and similar places.

1,581,284. METHOD AND CONSTRUCTION OF FUSING ELECTRICAL SOCKETS; J. G. Nolen, New York, N. Y. App. filed June 13, 1923. As in a hotel; to prevent the use of heavy energy-consuming devices such as flatirons.

1,581,357. ARC LAMP, ELECTRODE UNIT FOR THE SAME AND METHOD OF PRODUCING LIGHT; G. E. MacCormac, Los Angeles, Cal. App. filed Oct. 11, 1920. To produce intense sources of light.

1,581,380. THERMOCOUPLE CASING; R. P. Brown, Philadelphia, Pa. App. filed Nov. 30, 1926. Casing for a thermocouple immersed in a bath of a hot molten metal such as lead or the zinc-containing alloy used in making zinc die castings.

1,581,383. ELEVATOR SIGNALING SYSTEM; E. P. Butusov, Chicago, Ill. App. filed Oct. 16, 1919.

1,581,408. ARC LAMP; J. H. Wagenhorst, Jackson, Mich. App. filed Oct. 6, 1919. In which a plurality of pairs of carbons are simultaneously controlled by electromagnetic means.

1,581,417. METHOD AND MEANS OF UNITING COPPER TO STEEL; R. R. Applegate and J. B. Austin, Cleveland, Ohio. App. filed March 13, 1922. Arc welding; especially concerned with a method and means of uniting copper bonds to steel rails.

1,581,419. BATTERY; P. A. Barbosa, Buga, Valle, Colombia, South America. App. filed Oct. 31, 1924. Dry battery having a high amperage output.

1,581,429. HEATER PAD; H. P. Donle, Meriden, Conn. App. filed July 16, 1925. Constructed in such manner that the thermostatic means will act only at relatively long intervals and the thermostat will not be called upon to break the full line voltage when opening a circuit.

1,581,453. SWITCH-INTERLOCKING MECHANISM; D. C. Larson, Yonkers, N. Y. App. filed Jan. 16, 1924. Mechanical interlocks for magnet switches such as are used in an elevator door-interlocking system.

1,581,456. METHOD AND MEANS FOR BONDING RAILWAY RAILS; J. C. Lincoln, Cleveland, Ohio. App. filed July 18, 1918. The permanent electrical connection of railway rails, and particularly those in use under unfavorable conditions, such as exist in mines or with temporarily laid tracks.

1,581,457. MOTOR-CONTROLLING APPARATUS; D. L. Linquist, Hartsdale, N. Y., and D. C. Larson, Yonkers, N. Y. App. filed July 27, 1920. Particularly that used for traction elevators or frictional driving apparatus.

1,581,514. ELECTRICAL BOND; G. W. Conrad, St. Benedict, Pa. App. filed April 16, 1929. Electrical railway track bonds.

1,581,560. MULTIPLE-ARC LAMP; E. F. Winfield and O. Kerner, Los Angeles, Cal. App. filed Aug. 18, 1919. Adapted for motion-picture and other photographic work.

1,581,568. STORAGE-BATTERY CELL COVER; B. Ford, Philadelphia, Pa. App. filed June 30, 1925.

1,581,571. CONDUIT COUPLING; O. A. Fredrickson, Hartford, Conn. App. filed April 14, 1925. Designed to connect molding conduits for concealing electric circuit wires with conduit boxes, safety switch, cabinets and the like.

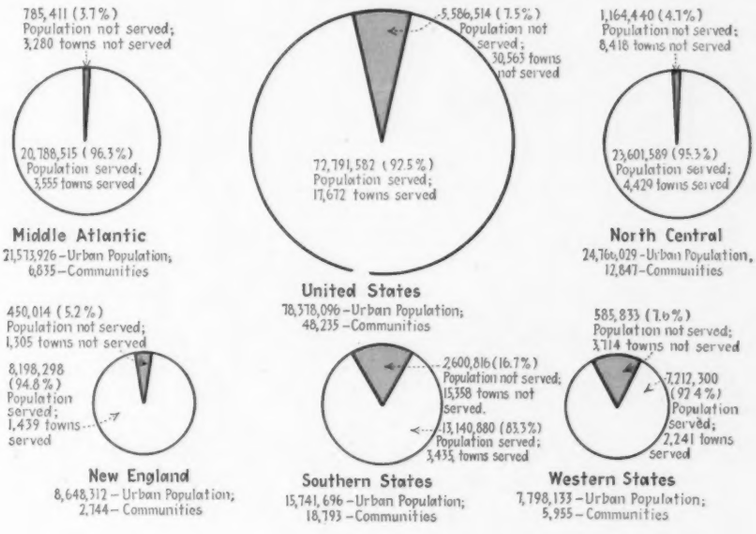
1,581,637. FUSE PLUG; O. H. Jung, Milwaukee, Wis. App. filed May 14, 1925.

1,581,690. TWO-FILAMENT STREET SERIES LAMP; A. L. Powell, Bloomfield, N. J. App. filed Dec. 19, 1921.

1,581,714. THERMOSTATIC TIME SWITCH; A. O. Appelberg, Stockholm, Sweden. App. filed Sept. 23, 1922. Used in electric light installations for lighting a lamp or set of lamps during a predetermined short period of time, and which are brought in operation in known manner by means of a push-button switch or the like, the latter, upon being operated, closing the circuit of the heating winding of the thermostat, which is then heated to close the lamp circuit.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business


785,411 (3.7%) Population not served; 3,280 towns not served
20,788,515 (96.3%) Population served; 3,555 towns served
Middle Atlantic
21,573,926 – Urban Population; 6,835 – Communities
5,586,514 (7.5%) Population not served; 30,563 towns not served
72,791,582 (92.5%) Population served; 17,672 towns served
United States
78,378,096 – Urban Population; 48,235 – Communities
1,164,440 (4.7%) Population not served; 8,418 towns not served
23,601,589 (95.3%) Population served; 4,429 towns served
North Central
24,766,029 – Urban Population, 12,847 – Communities
450,014 (5.2%) Population not served; 1,305 towns not served
8,198,298 (94.8%) Population served; 1,439 towns served
New England
8,648,312 – Urban Population; 2,744 – Communities
2,600,816 (16.7%) Population not served; 15,358 towns not served.
13,140,880 (83.3%) Population served; 3,435 towns served
Southern States
15,741,696 – Urban Population; 18,793 – Communities
585,833 (7.6%) Population not served; 3,714 towns not served
7,212,300 (92.4%) Population served; 2,241 towns served
Western States
7,798,133 – Urban Population; 5,955 – Communities

Population of Cities, Towns and Villages in the United States Served and Not Served by Central-Station Systems

Includes all towns having post office or city postal service

The Measure of Service

THE measure of a service is to be found in the diversity of that service. A service the beneficent fruits of which are confined to some small class of the country's population or which bears only on a single phase of the national life is a stunted service and cannot be classed as one of the country's basic economic factors. A real service is one of nearly universal application—one essential to the well-being of the country's economic life.

The electric light and power industry comes as near to providing universal service as any primary industry in the nation. Its benefits are just as applicable to the lowly home of the poor man as to the palace of the rich. It is the servant of the farmer, the miner and the manufacturer. It illumines the night life of the city and brings light and labor efficiency into the home. It transports the nation to and fro in the activities of the day, thereby conserving human energy for the problems at hand. The electric light and power industry is the answer to humanity's age-old search for a power which is applicable to all walks and callings of life.

It is a small and isolated community indeed which is not today served with electricity from the lines of some electric light and power company. A total of 17,672 cities, towns and villages now enjoy the advantages of electric light and power, and these communities contain 92.5 per cent of the country's urban population. There are still 30,563 towns and villages in the nation without electric service, but these communities are small in size, with an aggregate population of only 5,586,514, as against a population of 72,791,582 in the communities served from central-station lines. A very large proportion of the communities not served with electricity are hardly more than frontier trading posts—small, isolated collections of stores and dependent families subsisting upon the labor and production of the surrounding country, but within themselves wholly incapable of a continued existence and offering little incentive for transmission line extensions by companies operating in their section of the country.

There is not an essentially industrial community in the country which does not have electric service. The fact that industry in the aggregate is only about 44 per cent electrified from central-station lines does not discount the universality of such service. It only points to the fact that there is still room for central-station expansion in this direction as well as in the homes of the nation, which are still only about 7 per cent electrified.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

Industrial Activity in the North Central States

THE ELECTRICAL WORLD presents herewith a new service for its readers in the North Central States in the form of a barometer of various industries in that section. This barometer is based upon the energy consumption of about 400 large central-station power customers distributed throughout the section and in various industries. These monthly consumption data for each industry have been adjusted for seasonal variation and compared with the average annual consumption during the 36-month period 1923-1925. The monthly activity in each industry has been weighted in accordance with the importance of that industry to obtain the general industrial activity of that section. A barometer for the country as a whole will be found on page 1082 of this issue of the ELECTRICAL WORLD, and similar barometers will be issued for each section of the nation. These barometers may be obtained as soon as they are available upon application to the ELECTRICAL WORLD.

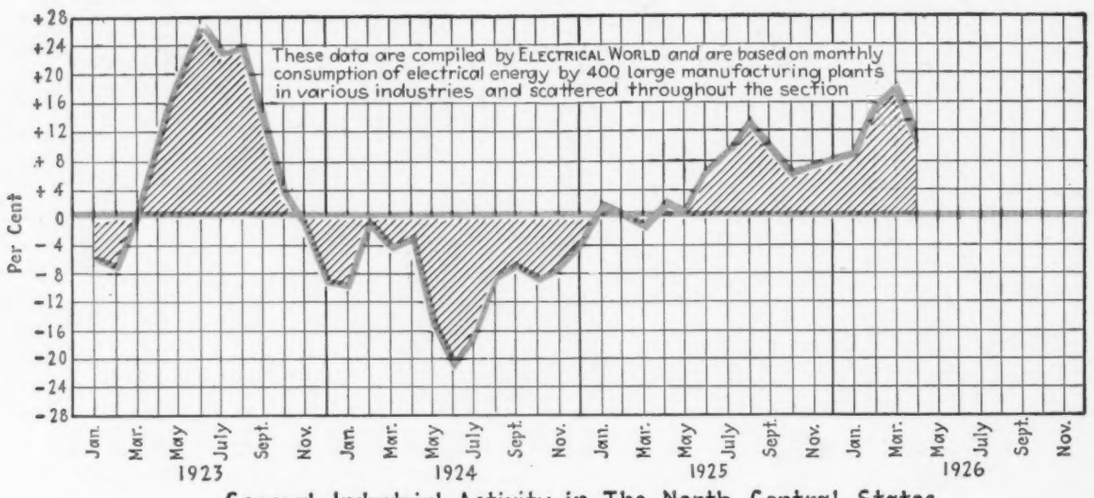
The month of April witnessed a distinct downward trend in the general industrial activities of the North Central States, although this curtailment in general industrial activity was not so extensive as that reported for the nation as a whole, and was materially above the industrial activity reported during April of last year. Of the six leading industries of the section, only two—paper and textiles—show an upward trend in operations after the necessary corrections have been made for seasonal variation.

The returns received by the ELECTRICAL WORLD indicate that during April general industrial activity in the North Central States was 10.3 per cent above the average monthly industrial activity for the past three years, as compared with an activity of 1.6 per cent above the average monthly during April of last year. In March general industry in the North Central States was operating at 17.5 per cent and in February at 15.5 per cent above the average monthly.

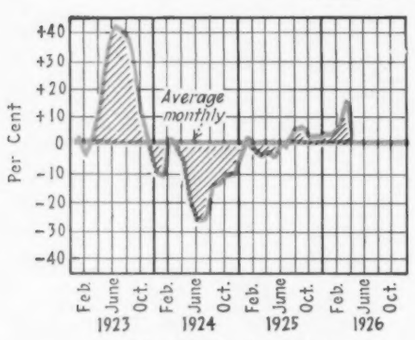
The metal industries of the North Central States reported activity during the month of April of 2.2 per cent above the average monthly.

The textile industry in the North Central States appears to have increased its activities slightly during April, but the chemical industry, the lumber industry and the transportation equipment industry decreased their activities during April.

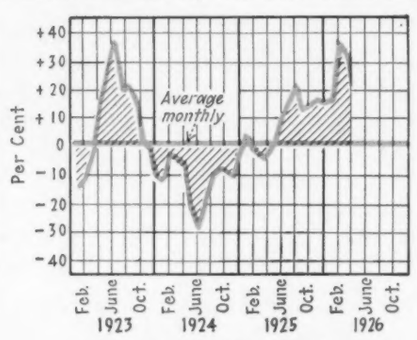
"Electrical World" Barometer of Industrial Activity in the North Central States



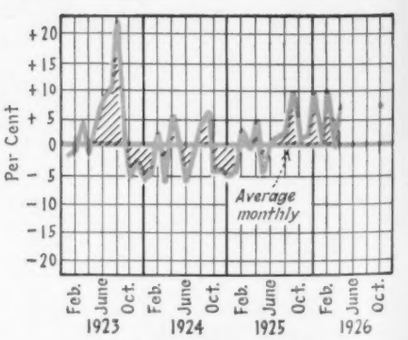
General Industrial Activity in The North Central States



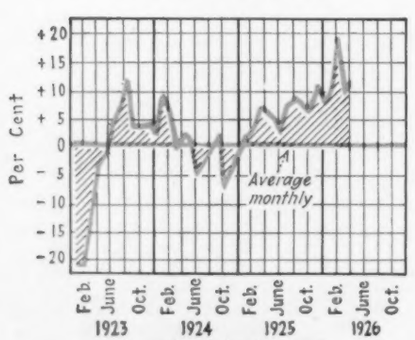
Metal Industries



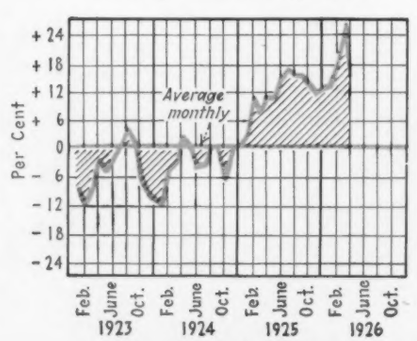
Transportation Equipment



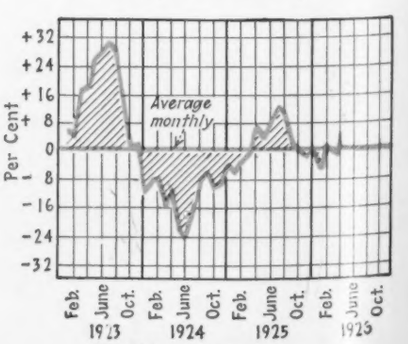
Paper Industry



Lumber Industry



Chemicals Industry



Textiles Industry